Mechanics magazine

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Iron

MECHANICS'

MAGAZINE.

VOLUME EIGHTH.

"In proportion as excellent productions shall multiply, every successive generation of men will direct its attention to those which are most perfect; and the rest will insensibly fall into oblivion. But the more simple and palpable traits which were seized by those who first entered the field of invention, will not the less exist for posterity, though found only in the latest productions."—CONDORCET.

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PREFACE

TO

VOLUME THE EIGHTH.

Man has been called a tool-making animal; and perhaps, among the various definitions which have been suggested to mark the distinction between him and the lower animals, there is none more appropriate. Of himself, he is physically one of the weakest of creatures; but from the moment that he could wield a stick in his defence, hurl a dart at a victim, or collect the sparks elicited by the collision of two pebbles, he may be said to have commenced a career of universal empire. Arming himself with one instrument after another—making all the elements, in succession, subservient to his will—gaining, at every step, some new command of means and resources external to himself,—this once most powerless of created beings stands forth, at last, the undisputed lord of Creation.

It may be said that it is the reason implanted in man, which prompts him to *make tools*. True; but take away the expanding influence of a constant course of inventing, combining, and applying, and in what state would that reason have been? Between the little glimmering of intellect which is seen in the act of scooping up water in a shell, and placing it on some burning sticks to boil, and that full blaze of mental energy which irradiates the triumphs of the steam-engine, how vast, how immeasurable, the distance! Would Philosophy, would Religion itself, have been what they are—so pure, so enlightened, so elevated,—but that man, wondering at what his feeble hands had accomplished, and struck with a grateful sense of the rich rewards

that crowned every effort of his industry, was irresistibly led to cast his thoughts back on himself—to examine his own formation, and meditate on the final purposes for which one "so fearfully and wonderfully made" was designed—to mark the grand distinctions between mind and matter—to see in himself, and in all around him, irrefragable proofs of the existence of a Power to which we owe at once Being and Responsibility;—

> "Resolving all events, with their effects
> And manifold results, into the will
> And arbitration wise of the Supreme."
>
> COWPER.

Much as man, however, has achieved, who can say that the work of his improvement is yet completed?—that he has acquired either all that he can, or all that is good for him? Nay, who is there, that, judging from the great things he has already performed, would venture to pronounce that he may not have others far more wondrous to accomplish, ere the measure of his destiny be filled up? The immortal Newton thought that in his day the great Ocean of Truth still lay beyond us, and that as yet we were but gathering the pebbles on its shore.

But although there is probably no person who would presume to set a limit to the progression of mankind; although there is none so kneaded of earth altogether, as to maintain that mankind, in the aggregate, should stop short in improvement, while a possibility of advancing a step farther remains;—there are those, who would have us believe that it is not equally good for every individual of the species to be equally unrestrained in the acquisition of knowledge. Some would allow certain classes only the liberty of going as far, and acquiring as much, as they can; others would permit to the world at large a general acquaintance only with an art or manufacture, and confine an intimacy with its details to those who practise them. Neither, we are sorry to say, is the inclination for restrictions of this sort confined to any one grade of the community. If there are individuals among the higher classes, who maintain that when mechanics have been taught to read, and write, and cypher, they have been taught all that it is safe or useful for them to know; there are also those among the lower orders, who hold as tenaciously the opinion, that the business of the rich and great is merely to purchase the productions of art, and by no means to inquire into, or meddle with, the processes by which they

are produced. A dread of being encroached upon actuates both, and is in both equally founded on selfishness and ignorance. Grant, that talent and acquirements may sometimes enable a poor man to elbow the wealthiest of the land; all that can be said is, that talents and acquirements have obtained their proper reward. Grant, that persons whom fortune has placed above the necessity of working for their bread, may be tempted, by a knowledge of the secrets of trade, to manufacture for themselves (the most common shape which this sort of apprehension takes); the number of such individuals must at all times be too small, to weigh as any thing in the balance against the manifold advantages to be derived from laying every operation of art open to the freest examination. As vain would it be for the polite and learned to disclaim all obligation to the many men of original minds whom the workshop has sent forth into the paths of literature and philosophy, as it is for the artizan to dispute the benefits which the polite and learned have, in their turn, conferred on the workshop, by visiting it occasionally, inquiring into its processes, and making use of their superior intelligence to point out the means of improving them. The names of Gifford and Carey are illustrious, but not less so than those of Howard and Cartwright. Every day is adding some new proof of the important influence exercised by the investigations of men of science, on the labours of industry. A more striking one could not, perhaps, be adduced, than is to be found in the volume to which these observations are prefixed. For centuries past, artists have been in the habit of lamenting that they could not obtain so excellent a varnish as shell-lac in a colourless state. A man of science, and no artist (Dr. Hare), has at length stepped forward to their assistance, and shown them a very simple means by which this object may be accomplished.

The only system which, in our opinion, can be safely, beneficially, or honestly, pursued in all that regards the spread of knowledge, is one of unbounded freedom. We would equally laugh to scorn the jealousies of trade and the jealousies of high station. We would away with all barriers, and have men to keep in mind that they are but the children of one common Parent, speeding forward to the same common haven of rest and happiness; and that in proportion as each shall be found to have lent a helping hand to his neighbours, he will in all probability be

deemed to have done his duty. Of two things we feel perfectly assured: first, that there is no man, however highly gifted or well-informed he may be, who can impart more instruction to his fellow-creatures, than he may receive from them in return; and secondly, that let a man learn and communicate what he may, he cannot thereby do aught but good to himself and others. Mr. Loudon has very truly remarked, that "the more a man's knowledge is increased, the greater will be his sympathies and enjoyments with every thing around him, and the greater his reluctance to disturb the system of harmony in which he feels himself placed."

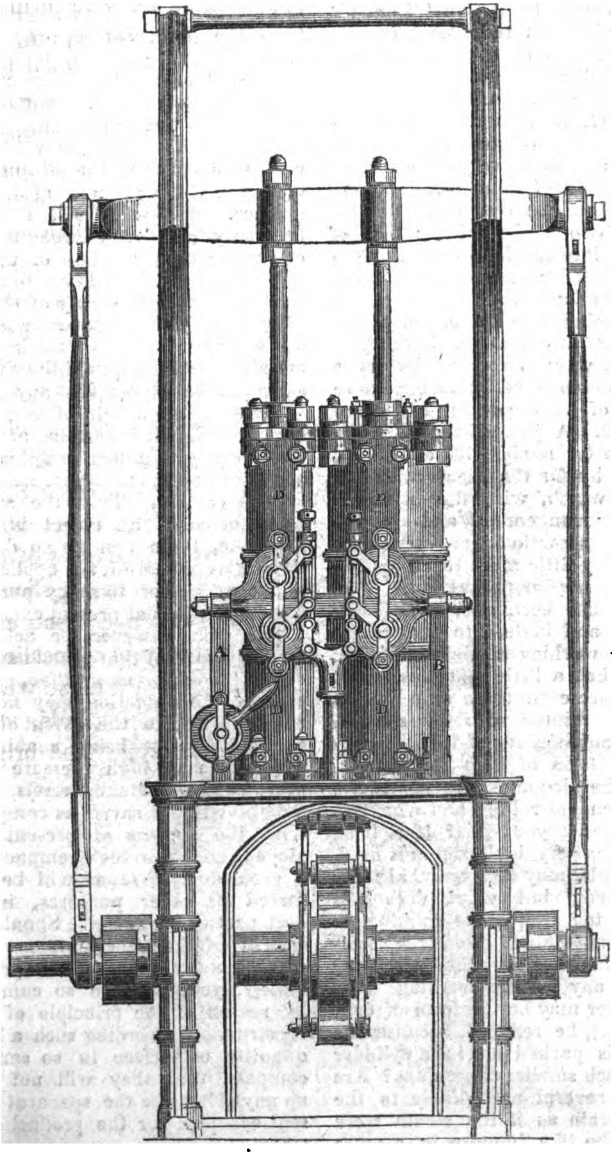
The reader may be disposed to infer, from our deprecating so strongly the spirit of concealment by which the practitioners of some arts are actuated, that we have ourselves been either greatly galled or inconvenienced by it, in the prosecution of our labours. For ample evidence that our censure proceeds from no such source, we need but refer to the pages of this our Eighth Volume, from which it will be seen that we are still, as heretofore, honoured with a degree of active and able support from men of all classes, which leaves us on that head nothing to desire. It is not because we have to complain of others for concealment that we have thought it expedient to touch on the motives from which it usually springs, but because others have complained of us for making public more than it seems to them it is fitting should be generally known. We should like to make every one as persuaded as we are ourselves of the impropriety of concealing any thing that can be of use to others; but if there are those who will still cling to darkness and secrecy as their best friends, we are willing that their reproach shall be considered "the brightest jewel in *our* crown."

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 204.] SATURDAY, JULY 21, 1827. [Price 3*d.*

GILMAN'S HIGH-PRESSURE STEAM-ENGINE.



GILMAN'S HIGH-PRESSURE STEAM-ENGINE.

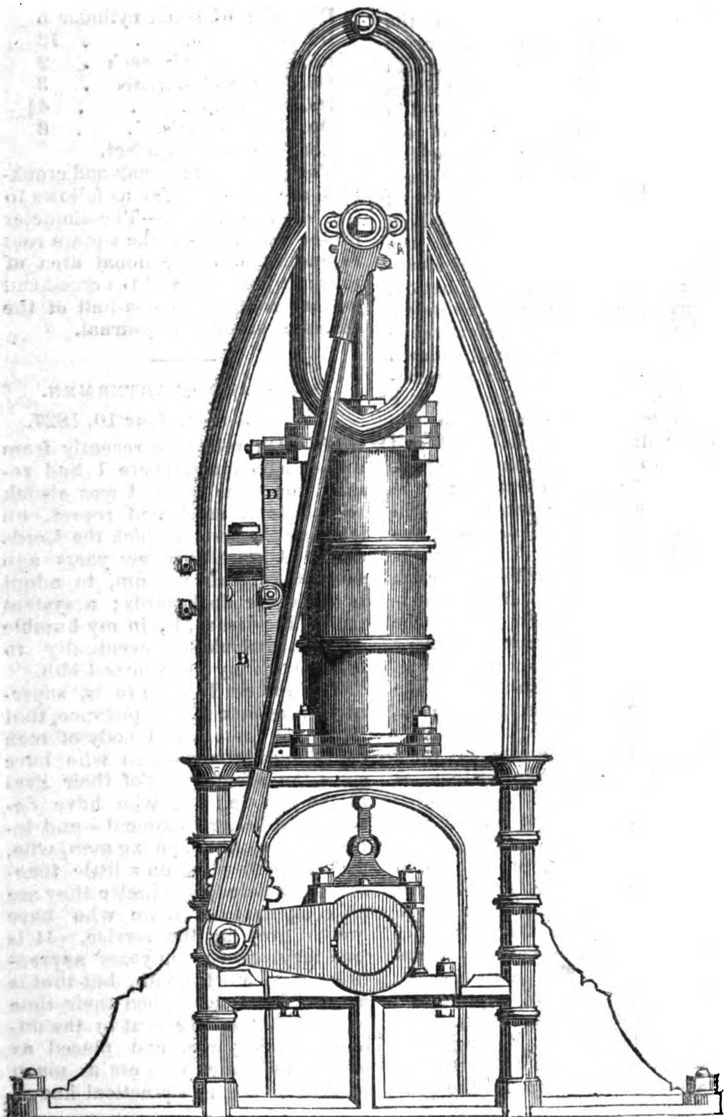
We have already laid before our readers descriptions of Mr. Gilman's plans for producing steam, both under high and low pressure; and we now proceed to abstract from his communications to us some farther observations on high-pressure engines, and a design of one on the principle he has unfolded.

Mr. G. is of opinion that the simple energy of steam, as a prime mover, admits of very little variety in the mode of its application, and may, indeed, be considered as confined to two modifications: that of allowing it to flow from the boiler into the cylinder from the commencement to the termination of the stroke; and that of being cut off after the piston has passed through some determined distance, when the remainder of the stroke is completed by the expansive action of that portion of steam admitted. A judicious application of the latter mode will, he thinks, produce by far the greatest effect; beyond which, with due attention to the arrangement and to the perfect construction of engines, there is probably little more to be gained from steam *after* production.

Much has been said of reducing engines and boilers to the weight of mere working models. Mr. G. thinks that a little reflection ought to convince even those who are but little acquainted with the subject, of the impossibility of this. In the simplest form of high-pressure engines, the air-pump, condenser, &c. have been got rid of; and what can be effected beyond this? It is true, that when very high steam is used, the cylinder may be somewhat more contracted; but what does this amount to? Ought the framing to be less substantial? or can the cross-head, side-rods, cranks, shaft, or in fact any of the working gear (whatever may be the form of construction), be reduced, because the power is packed up in a cylinder of so much smaller dimensions? Are not the several parts liable to the same strain as if the steam were giving the like impulse in a more expanded state, in a larger chamber? How, then, can it be possible for any considerable reduction to be made, as these parts constitute the chief weight of such engines?

The reduction in the weight of *boilers*, too, Mr. G. is inclined to think will be found to arise more from the profit obtained by using steam of high pressure, than from any great saving in its production. Water is not charged with heat so readily, when of the temperature of 400 or 500 degrees, as when the difference between the temperature of the fluid and heat applied is greater. Hence it will still be necessary to expose a large quantity of surface to the action of the fire and the heat of the flues, to maintain the required supply of steam; so that, when due allowance is also made for the additional thickness of metal that will be required, there seems no reason to expect that any great reduction in the weight of boilers can be effected. It is certain, at least, that nothing of much practical importance has been, as yet, achieved in this respect. That the attainment of such an object is most desirable, there can be no doubt; since it would permit the application of steam power to many purposes from which it is at present excluded. Much will, however, be achieved for the benefit of that grand national object, *steam navigation*, even though the reduction may not be accomplished to the extent of our wishes; for, by being enabled to use engines of high pressure with perfect safety in steam-vessels, much weight will be saved as compared with the engines at present employed; and, from their compactness, a great deal of room will be preserved for other purposes, in the best part of the vessel. Should the weight of the generators never be much less than that of the present boilers, yet they are so compact, by reason of the principle of their construction affording such a large quantity of surface in so small a compass, that they will not take up any thing like the space at present occupied for the production of steam.

The saving of a few tons of metal, Mr. G. considers to be not an object of so much importance as the saving of room and of fuel, in this particular application of the power. Fuel, from the large store necessary, not only contracts the means of stowage considerably, but materially limits the distance of passage, and requires to be continually replenished at a great expense; while the few tons of metal are permanent, and therefore of less importance. Besides, high-pressure generators, on the tubular plan, will be found to be perfectly harmless, should any of



their parts give way; and such dreadful explosions will be never experienced from the use of them, as so frequently take place with low-pressure boilers. In addition to these advantages, high-pressure engines may, from their simplicity, be so framed, as to subject the vessels to much less strain than they experience from the present engines.

The engine represented in the prefixed engravings (not a marine engine) is of 30 horse power, with two cylinders having their pistons acting in conjunction, supported in a gothic frame composed of six pieces. The ends, each of which is formed complete in one casting, are firmly connected by low arched pieces at the front and rear, making an uniform arrangement with the like arches, as seen in the end elevation, and which, in conjunction, support the plate and cylinders standing thereon. The steam-pipe is carried from the generator down to the floor, under which it is conducted to the engine-frame; where it rises within the angle to the cylinder plate before mentioned, and is fixed to the eduction passage A seen in the front elevation: (the letters refer to the same parts in both figures:) D D D D mark the passages leading from the four cocks to the top and bottom of each cylinder respectively; B the eduction passage, through which the steam is conveyed under the floor to any convenient place of escape. The steam being admitted by the cock in the induction passage A, the four cocks at the passages D D D D direct its energies to their respective sides of the pistons at each change of motion, and ultimately to the passage B, whence it escapes into the atmosphere.

In using this engine without a condenser, the steam may be cut off when the small cylinder is half full, which allows of its expanding to eight times the volume before its escape; but with a condenser, the steam is cut off at a quarter of the stroke, and expands sixteen times before it enters the condenser.

The steam-cock is not represented in its proper situation in the passage A, as the figure would not admit of shewing either that or the method of acting on its lever to cut off the steam. The cocks of this engine being of an original and peculiar construction, will be explained in section in some future number.

Proportions.

	inches.
Diameter of small cylinder	6
Do. of large do. . . .	12
Do. of piston rods, each .	2
Do. crosshead journals .	3
Do. crank-pins.. . . .	$4\frac{1}{4}$
Do. shaft journals. . . .	6
Length of stroke, 3 feet.	

The crosshead journals and crank-pins are proportioned as follows to the shaft journals:—The diameter of the crank-pins is the square root of one-half of the sectional area of the shaft-journals, and the crosshead journal is equal to one-half of the diameter of the shaft journal.

DOCK-YARD QUARTERMEN.

London, June 10, 1827.

Sir,—On returning recently from a foreign country, where I had resided for some years, I was struck with astonishment and regret, on learning the system which the Lords of the Admiralty a few years ago saw fit, in their wisdom, to adopt towards the dock yards; a system which, if pursued, is, in my humble opinion, calculated eventually to bring the Navy to its lowest ebb.

The system I allude to is, superannuating, on a slender pittance, that large and most useful body of men called quartermen—men who have spent the greater part of their lives in the service, and who have deserved far better treatment—and introducing a class of young men, who, priding themselves on a little theoretical knowledge, conceive they are as competent as those who have grown grey in the service. It is true they serve seven years' apprenticeship at Portsmouth, but that is a mere farce; and when their time is expired, they are sent to the different dock yards, and placed as officers over men who are as much superior to them in practical know-

ledge as they are inferior in rank; and were it not for some officers of the old school being placed over them, these gentlemen-shipwrights would have to trust entirely to the men over whom they are appointed, and who should naturally look up to them for information and instruction; whereas it is the reverse. It appears that the rulers of affairs are disposing of the old officers pretty quickly; or, not allowing them to rise from their situations, suffer these young gentlemen to step over their heads, and fill offices which ought to be given to men of sound judgment and great experience, whose services have entitled them to preferment. It really must be disgusting to old shipwrights, to see that their young officers hardly know one part of a ship from the other, with all their great pretensions: there are a few exceptions, and but very few. Quartermen in the dock yards are as sergeants in the Army; and it would be a similar stroke of policy to discharge all the sergeants, and leave the Army to be disciplined by young officers who hardly know the butt from the muzzle of the gun; and it would have a similar effect.

Should you consider these few remarks, Sir, worthy of a corner in your most excellent Magazine, I shall be highly honoured by their insertion.

I am, Sir,
Your obedient Servant,
C. W. E.

SINGULAR PROPERTY IN THE HUMAN HAIR.

Mr. W. Tulley has discovered a singular property in almost all (human) hairs, which I do not think has ever been remarked or described. If a hair is drawn between the finger and thumb, from the end to the root, it will be distinctly felt to give a greater resistance and a different sensation to what is experienced when drawn the opposite way; so that, if the hair is rubbed between the fingers, it will only move one way (travelling in the direction of a line drawn from its termination to its origin, from the head or body), so that each extremity may be thus easily distinguished, even in the dark, by the touch alone. The mystery is resolved by the microscope. A hair, viewed on a dark ground as an *opaque* object, with a high power not less than that of a lens one-thirtieth of an inch focus, and dully illuminated by a cup, which seems to answer best, is seen to be indented with teeth somewhat resembling those of a coarse round rasp, but extremely irregular and rugged; as these incline all in one direction, like those of a common file, viz. from the origin of the hair towards its extremity, it sufficiently explains the reason of that singular property I have described. This is a singular proof of the acuteness of the sense of feeling; for the said teeth may be felt much more easily than they can be seen. We may thus understand why a razor will cut a hair in two much more easily when drawn against its teeth than in the opposite direction.—*Dr. Goring—Quarterly Journal of Science.*

Dr. G. is mistaken in supposing that the property which he so accurately describes has been now for the first time "discovered." Many are the thousands who have observed and experimented upon it before him; and but that, like the object of their admiration, they were rather of the *minute* order, their experiments would, doubtless, have occupied a more conspicuous place than they do now in the annals of science. Dr. G. directs the hair to be drawn "between the finger and the thumb; but school-boys and girls will, probably, still prefer their old practice of drawing it between the lips, as possessing greater acuteness of touch.

HINTS ON THE EFFECTS OF SALT AND ACIDS GENERALLY ON THE HUMAN SYSTEM.

Mr. Editor,—As you have been good enough to insert my article on human food, allow me to troubl you with this also. The injudicious use of salt throughout this country, is an evil of great magnitude. Blind

habit has led the ignorant into the general use of this article to such an extent, that some people scarcely know the natural taste of food in the pure state. In whatever sort of form, whether it be vegetable or animal food, there seems a mania for pickling; as if nature had not done above a fraction of her duty in producing wholesome food for our use.

The human system, in the healthy state, has its juices sweet and pure, until this vile practice of pickling and seasoning contaminates it. This work of destruction begins at the birth; the improper mode of living injures the nurse's milk; and, from infancy to adult age, the constant use of acids accumulates in the system, and frequently overwhelms it, so as to require medicine to keep the frame in any tolerable condition of health. Such, indeed, is the wild race of luxury and debauchery, that *very few* sound constitutions can go on any length of time without medical advice; whereas, those individuals who are occupied in rural affairs, and who live on a simple and ample fare, seldom require any medicine. The inhabitants of cities are always impatient for changes; to have things in season, as commonly called, they will meddle with fruit before Nature has done her wise operation of ripening. Hence, during the fruit season, vast quantities of acrid humours are generally accumulated.

Another medium for conveying salt into the human constitution is bread; for the baker, or his man, must have a finger in the bakings, as well as in the pie. These worthies convert down-stairs into a very laboratory. A half-pound of salt, and a little alum, &c. is the nominal quantity to a bushel of flour; but I maintain, on rational grounds, that half a grain even of the former is too much. The fraternity of composition bread-makers plead, as an excuse for their compounds, that the loaves would not separate without the dough had been thus prepared; and that whimsical customers are so troublesome, they must have two crummy sides. But why join the loaves at all? A mould of tin, or stone-ware, would keep them in good shape, and with little crust; therefore the health of human beings should not be sacrificed to suit humoursome fools, nor at the will of ignorant men to suit their selfish views, under the mask of unavoidable expedience. All such arguments are as untenable, as their dirty trick of stamping with the bare feet in the dough is loathsome and indecent. I recommend this department of preparing human food to revert to the women, from whom it has been so improperly wrested in order to form a separate branch of trade, ruinous to our constitutions and pockets.

The next vehicle for conveying acids into the human frame is London Porter, as vended by our common sinning publicans. These folks also practise chemistry; and, under the shelter of license for tobacco, consume a vast deal more of it than the smokers use. Whoever will analyze the dregs of one of their beer butts, will discover ample proofs of drugs, including salt, tobacco, &c. &c. Seasoned victuals excite thirst, and this sort of fermented liquor adds to the painful sensation, so that the working people are in perpetual torment. Their miserable lives last not one half their natural duration. They are ever craving, and never satisfied; the supply can never meet, nor keep pace with, the demand; until at length diseases, thus generated, have made such inroads on their constitutions, that they can neither eat, nor drink success to competition or free trade (in drugs and beer).

Though I condemn the indiscriminate use of salt in the crude state, as well as in high-seasoned provisions, I admit its vast utility in certain cases, and in moderate quantities. In cases where it is at all necessary, a very small portion of what is now commonly used would be enough. Here all the retailers will become irritated like wasps, croaking for their loss of trade, on the people adopting my plan. To these I would reply, that society would be much more happy

with one in a hundred of them, as the remaining ninety-nine could be otherwise amply and usefully employed. And as to the consumption of salt, I would recommend its increase many-fold by manuring the land with it. If this excellent practice were more universally adopted, the corn raised on such grounds would be better in quality and more in quantity.

Land, so improved, would produce more wholesome herbage and fodder for cattle; so that human beings would reap the benefit of salt thus applied, which science proves to a demonstration is a more natural way than hitherto adopted in using it to such excess in the direct form.

Salt, vinegar, spirits, &c. generate oxygen; the presence of which is always manifest in cases of rheumatism, gout, scorbutics, &c. Patients labouring under the former maladies know, by the increase or removal of their pain, the approach of a shower or cold air. Saline matter, in any situation, attracts humidity. To illustrate this, I need only refer to the fact, that a stone dug from a rock that had been washed by the sea, placed in a wall at any distance from its original situation, will be moist at the approach of rain and in cloudy weather.

If butter cannot be preserved without the usual quantity of salt, it might be washed out with pure spring or pump water previous to our using it at table.

As to bacon or pork, Moses had a good reason for prohibiting hogs'-flesh among the Jews—and so ought we; for this filthy animal is the scavenger of every offal in its most offensive state. If these are worth rearing at all, let them be condemned to the dung-hill, to manure the land with. This animal was never intended for human food.

Your's respectfully,

Kennington. GLOBOSUM.

(*To be continued.*)

MOMENTUM OF FALLING BODIES.

Sir,—I have been not a little puzzled by a question put to me by one of my children, in consequence of a discussion which he had read in your Magazine; and if some of your numerous philosophical correspondents will be charitable enough to answer it for me, I shall take such kindness as a real obligation. The question is this: "It is held that all heavy bodies fall near the surface of the earth, through 16¼ feet in the first second:" Does this apply alike to bodies of various matter, one cubic inch of wood and one entire inch of lead? I have made the experiment of dropping these two bodies from our top window at the same time, and found the lead reach the bottom before the wood; how is this? Again, I found a pound of lead reach the bottom before an ounce of lead did; a round body of lead weighing a pound, reached the bottom before a flat sheet of lead, weighing a pound, did; how can these experiments be made consistent with the single rule laid down respecting falling bodies?

I am an old subscriber and well-wisher to your Mechanics' Magazine; my children, too, are all readers of it, and will eagerly look for an answer, or answers, in some of your next numbers, to a question which their father is too ignorant to answer.

I am, Sir,
Your most obedient Servant,
ABEL DABBLER.

Prescot, June 30, 1827.

THE THAMES TUNNEL.

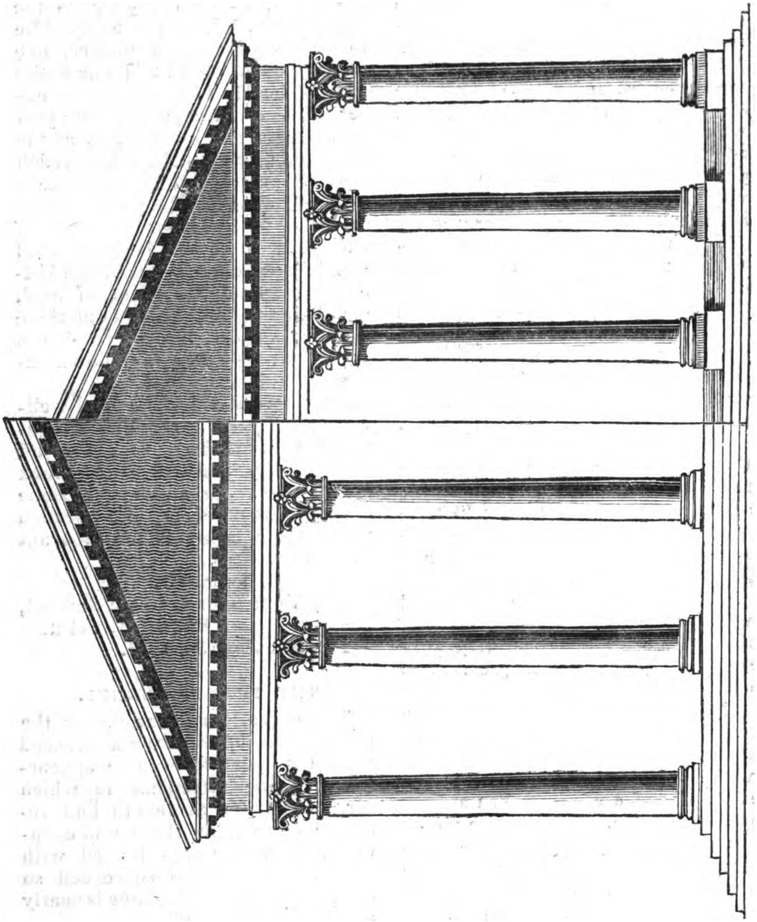
The operations for resuming the prosecution of this work proceed with the most favourable appearances. The expedient to which Mr. Brunel has at length had recourse, of covering the line of excavation by tarpaulings loaded with clay and iron, has succeeded so completely, that the leakage is nearly at an end. There have been *three* tarpaulings sunk; the last, of four canvasses thick, and about 100 feet square. The length of the principal hole appears to have been not less than 20 feet. Already the whole of the upper tier of boxes have been cleared of the mud with which they were filled, and the miners are now proceeding actively with the clearance of the two other tiers.

COMPARATIVE PROPORTIONS

Of the Porticos of the Churches of St. Martin-in-the-Fields, and St. George, Hanover-square; from Actual Admeasurement.

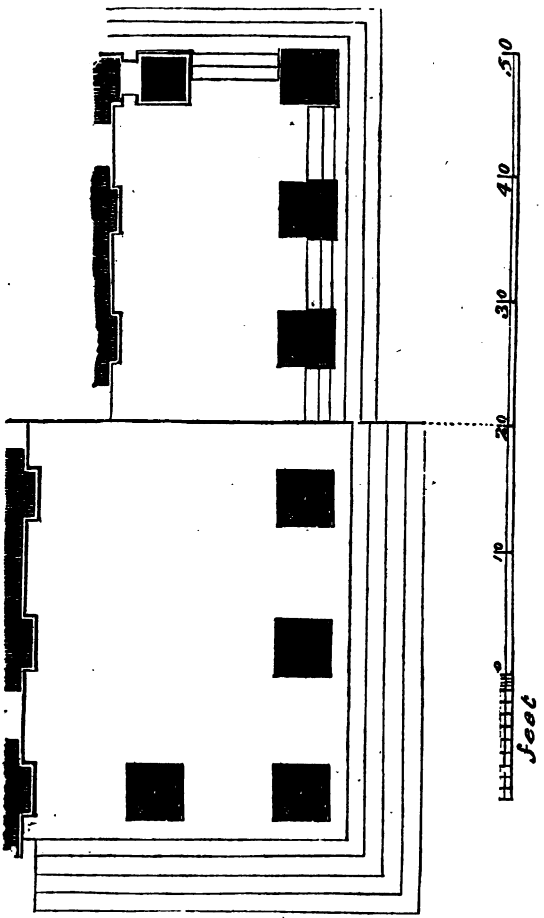
BY MR. C. DAVY,

Teacher of Architecture, &c. London Mechanics' Institution.



Sir,—Among the many superb buildings with which London abounds, none have acquired greater architectural celebrity than the two which furnish the subject of the present communication. Taking into consideration the great difficulty of adapting architectural beauty to internal convenience, we may safely venture to affirm that the church of St. Martin-in-the-Fields is decidedly superior, in both of these particulars, to any other in the metropolis. St. George's church, as far as regards the design of the interior, falls unfortunately short of what we are led to expect from the chaste and elegant appearance of the exterior. The following excellent remarks, from the pen of Mr.

Malcolm, deserve attention, from their truth and propriety:—"There certainly never was a greater contrast in architecture designed by the same person, than is observable in this church; the front of which equals the temples of the ancients, while the interior would almost disgrace the worst of their productions. It is dark, disproportioned, and the orders are inverted in their gradations: the six *Composite* pillars of the nave are elevated on the same number of *Tuscan;* two marble *Ionic* pillars support the organ-gallery; and the sides of the sacrarium consist of two *Tuscan* pillars with a *Composite* arch; the vaults of the nave contain *Tuscan* pannels; and the arches of the aisles, CORINTHIAN *lozenges with decorations!*" In recommending the study of the proportions belonging to the two magnificent hexastyle porticos with which these buildings are embellished, Mr. Malton* observes, "that the portico of St. George's, Hanover-square, is inferior in majesty to that of St. Martin's, but is superior to *every other.* * * * An accurate examination and measurement of these two porticos would be an advantageous study for a young architect; and *geometrical drawings,* placing their *dimensions* and *proportions* in a comparative view, would be a valuable addition to his library."



In the accompanying drawings, which I made from actual measurement, some time back, the result of this study will be clearly seen, and I hope will prove useful. Both the plans and elevations are drawn to the same scale, thus placing, in a convenient manner their "dimensions and proportions in a comparative view."

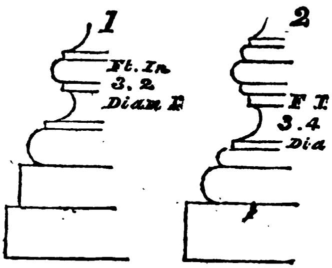
Proportions.

Both porticos are hexastyle, *i. e.* have six columns in front. Each

* Picturesque Tour, p. 106.

intercolumniation of St. Martin's is two and a half feet diameter, and of St. George's two and a quarter. The centre intercolumniation of St. George's is three feet diameter; the intercolumniations of St. Martin's are all equal.

The base to the columns in St. Martin's is of the form represented by fig. 1; that of St. George's (the attic base) of the form of fig. 2.



It appears that the architect of St. Martin's (Gibbes) took, as his model for the Corinthian columns, the beautiful example of the temple of Jupiter Stator (Rome); as the centre horns or volutes are entwined one within the other, in a similar manner; the abacus likewise is ornamented, though in many parts it is nearly obliterated. It is to be hoped, that when the improvement in this part of the town takes place, a complete cleaning and restoration of this fine building will not be forgotten.

The pediments of both the porticos are surmounted with an acroteri, or small pedestal. The remaining proportions and *dimensions* (by the scale attached) will be clearly explained by reference to the engravings. Mr. Joseph Gwilt, architect, has given an excellent and scientific memoir of this church (St. Martin's), in a valuable architectural work, entitled, "Illustrations of the Public Buildings of London," edited by J. Britton, Esq. F. S. A., and A. Pugin, Esq. architect.

The purport of one or two of his observations upon this church ought not to be overlooked:—"The superficies of the church is 12,660 feet; of this the points of support occupy 2803; the ratio is as 1 to 0·220. He (Mr. Gwilt) does not conceive Gibbes to have been guided in his proportions by any ratio between the length and breadth of the church, except in one part; and it is a question, if he was aware of the circumstance—viz. "that the length from the plinths of the columns of the portico to that of the east front, is double the width of the church." In the buildings of Wren, we are invariably struck with his devotion to proportion; and in this respect, his theory and practice went hand in hand. In his "Parentalia," page 351, he says, "There are natural causes of beauty; beauty is a harmony of objects, begetting pleasure to the eye: there are two causes of beauty—natural and customary. Natural is from geometry, consisting in uniformity; that is, equality and proportion. Customary beauty is begotten by the use of our senses to those objects which are usually pleasing to us for other causes, as familiarity or particular inclination breeds a love to things not in themselves lovely. Here lies the great occasion of errors; here is tried the architect's judgment. But always the true test is natural or geometrical beauty."

RECEIPT FOR PRESERVING FRESH BEEF OR MUTTON.

Sir,—The following method may be employed for the preservation of fresh beef and mutton:—

As soon as the meat is cold, let it be cut up in quarters, and sprinkled with the following ingredients: *lignum vitæ, in fine chips*, one pound; *common salt*, four ounces; *coarse sugar*, four ounces; *salt prunella*, half an ounce: when it has been well-sprinkled, close the whole in sheet lead, lay it in a chest, and fill it with fresh sawdust. When it is taken out to be dressed, it must be scraped and wiped very clean, and roasted as quick as possible. Meat thus prepared may be kept two months in the finest order.

I am, Sir,

JAMES COX.

VALLANCE'S NEW MODE OF CONVEYANCE.

Mr. Editor,—I really do not feel much inclination to stir any farther in a controversy with one who can only bring abuse and contempt in answer to a straight forward argument; but, lest some of your readers should construe my silence into acquiescence in Vindex's opinion (for it is with him a mere matter of opinion), I will trouble you with these few lines.

I must confess I cannot see the aptness of V.'s comparison between himself and Frederick the Great, as *I* have not spoken calumniously of him; and if I had, though there were no necessity for "*an army of one hundred thousand men*," I evidently brought more reason with me than Vindex can controvert, as he does not even attempt it. If V. had *shown and proved*, by fair argument instead of again using his bare assertion (a mode of disputing which V., for obvious reasons, is particularly expert at), that my remarks were absurd, and "utterly unworthy the slightest attention," it would then have been time for him to express his great contempt for them; but, having failed in doing this, I think a little more courteous language would have better suited his case.

There is no difficulty in showing that the Newcastle carriages can go, or could be made to go, if necessary, at the rate of one hundred miles per hour; though this is not twenty times faster than they move at present, as I have travelled myself on some of them between six and seven miles per hour; and I have been informed, from very good authority, that some go at the rate of ten miles per hour.

It is merely necessary to increase the power of the engine proportionally to the required speed. Suppose the traction of a carriage moving at the rate of five miles, or 26,400 ft. per hour, to be equal to 68lbs.; this will be found to be about one horse power: now as the friction of the wheels does not increase with the speed, it is still only necessary to exert a force of 68lbs.; but now, over 100 miles, or 528,000 ft. in the hour, this will be found to equal twenty-horse power; something more would be required to overcome the resistance of the air which a body, moving at that velocity, would experience. I am sorry I have not a table of resistances with me, or it would be easy to show what that resistance would be. I would here observe, that I think it scarcely possible to make carriages strong enough to stand this velocity; but, as this objection cuts both ways, it has no bearing on the point in dispute.

As to my quotation from the Chevalier Couling's Report (though it was by no means essential to the argument), I think I can still show that the Chevalier came to a wrong conclusion on the subject. He says the wheels may be larger, "owing to their being always kept in an exactly perpendicular position, and consequently free from the strain thrown on the spokes of a common carriage-wheel by the deflection from the perpendicular, which the nature of and obstructions upon roads continually occasion." This, I presume, means that they run on railways; and I think it is expressly said so in one part of his Report (I have it not with me to refer to): if so, the Chevalier is certainly *rather mistaken* in supposing railways to be one of the *peculiar advantages* of Mr. Vallance's method, as they were in use long prior to Mr. V.'s birth; and, from all I have heard of Mr. V.'s plan, he has no method of keeping his wheels vertical, but what is common to all well constructed railways.

The motto Vindex winds up with is certainly an odd one for *him* to select; with all humility, arising from a consciousness of my ignorance and inability, I cannot but observe that Vindex has not shown himself to be *one* of the seven wise men who can *render a reason*.

Your's truly,

J. F. E.

Sir,—It is not my intention to enter into any discussion of the merits or

demerits of the above plan—my object is to suggest an improvement; which improvement would consist in having a communication between the ends of the tunnel and the furnace of the steam engines. All other communication being cut off, this would cause a considerable current of air to pass through the tunnel to supply the place of the rarefied air ascending the chimney, and for the support of combustion.

Your obedient Servant,
A. MACKINNON.

SIMPLE METHOD OF COATING IRON WITH COPPER.

Take a cistern of wood, of a size suitable for the articles required to be coated; fill it with rain or river water; put up a small furnace; the best form, I think, is that used in rolling-mills for heating iron with anthracete but it need not be more than one-third the size. Any other kind of fire that will produce an uniform heat may answer. Then take scraps of sheet copper, or any other copper most convenient; heat them to a bright red, sufficient to oxydize the surface, but not to melt the copper; then quench them in the cistern of water; continue to heat and quench them, until more than a sufficient quantity of copper is oxydized and disengaged, to coat the articles required; stir the water well, and deposit the articles intended to be coated in such a position that they will be entirely covered, and the water have free access to every part; leave them in this situation from five to ten days, and they will be completely coated with copper. A kettle, for instance, made of sheet iron, and deposited in the solution, will become completely coated inside and out, and will appear as if made of sheet copper. The longer the articles remain in the solution, the thicker will be the coating.—*Joshua Malin, Amer. Mech. Mag.*

Dr. Jones, the intelligent editor of the "American Mechanics' Magazine," while giving this receipt, expresses some doubts of its efficacy. "The only action," he observes, "which can exist in this case, must result from the *accidental* presence of some acid, for in *pure* water there would be no sensible action." We should, like Dr. J., be glad to *see* an article covered with copper by the foregoing process, *accompanied with an analysis of the water made use of.*

EXPANSION OF SOLIDS BY HEAT.

A remarkable instance of the use of the power with which solids expand by heat, occurred in Paris some years since, in a method which was used to force together the walls of a gallery in the Abbey of *St. Martin*, now the *Conservatoire des Arts et Métiers*. The weight of the roof was forcing the walls of this building asunder, and they were restored to their perpendicular position by the following method:—Holes were made at opposite points, in several parts of the walls, through which strong iron bars were introduced, so as to extend across the building, and so that their extremities should extend beyond the walls; large nuts were placed upon their ends, and screwed up so as to press upon the walls. Every alternate bar was then heated by powerful lamps, so that its length increased by expansion, and the nuts, before in close contact with the walls, retired to some distance from them. The nuts were then screwed up to the walls, and the bars cooled. The process of cooling restored the length of the bars to what it had been before the heat had been applied, and the nuts were drawn together by an irresistible force, and consequently the walls drawn towards each other. The same process being repeated with the intermediate bars, and this being continued, the walls of the building were gradually restored to their perpendicular position.

ENORMOUS WATER-WHEELS, ON AN IMPROVED CONSTRUCTION.

Messrs. Fairbairn and Lillie, of Manchester, are now constructing,

after the plan of a Mr. Hewes, of the same place, four water-wheels of very extraordinary dimensions, which are to be applied to the movement of cotton machinery in Scotland. The shrouds, centres, and shafts, are of cast iron; the buckets and arms of wrought iron; each wheel is of 96 horse power, 50 feet in diameter, and 54 tons weight; the width of the buckets is 12 feet. These wheels will all communicate with one shaft, which will convey their immense combined power into the cotton manufactory, where they are to be used. In water-wheels of the ordinary construction, the power is carried through the axis of the wheel, into the mill, and consequently the arms or radii must be constructed of strength sufficient to bear the power they transmit; and, when loaded, the axis has not only the weight of the wheel, but the entire stress of the whole amount of power transmitted: the consequence is, that, besides a great loss of power, the shaft and arms are frequently broken by the pressure: wheels of the power of those now constructing, could not be made upon the old principle; for the weight and strength they would require, would render them entirely inefficacious. In the improved construction, by removing the carrier-wheel from the centre to the internal circumference of the water-wheel, the whole weight of the water is thrown upon the carrier wheel, and no more strength is required in the arms of the water-wheel than is necessary to carry the wheel itself; and the actual stress on its axis is less when loaded with water than when empty, whereby a vast increase of power is gained, and the risk of accidents done away.

LIGHTNING CONDUCTORS.

Sir,—It will give me much pleasure to discuss the question as to lightning conductors with your correspondent Amicus, notwithstanding his very mistaken view of the subject he has attempted to discuss, if he will confine himself solely to experiments and phenomenon, and thus prove his assertions and disprove mine.

Although I claim no pretensions to the title of philosopher, yet have I proved all I had previously advanced, in opposition to lightning conductors as protectors to ships and buildings. For more than thirty years I have made notes of the phenomena I witnessed in every quarter of the globe, and resorted to experiment to confirm the ideas I now advance, and had consequently formed, of the danger of inviting electric fluid to ships and buildings; and such practical knowledge, together with phenomena which are frequently occurring, to confirm all I have stated, causes me not to yield to the assertions and inferences of men who have only taken theory and fancy for their guides.

As your correspondent has not named any of the experiments I had made, nor referred to actual phenomena,* such

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* The following are some of the principal phenomena alluded to by our correspondent: —

"Professor Richman was in the act of making some electrical experiments. He had placed a conductor at the top of his house, to which he had fastened a chain; this he conducted to his chamber. The conductor was affected by the lightning, which passed down to the Professor; a person near him saw a fire-ball, as large as his fist, jump from the conductor towards the head of the Professor, which killed him on the spot. He was at that instant a foot distant from the conductor, which was broken in pieces, and much damage done to the house. *The Professor's house was the only one having a conductor in the town, and the only one attacked by lightning.*"

"His Majesty's ship *Perseverance*, Capt. J. Smith, off Bengal Bay, was struck by lightning and much injured; one man killed, and many wounded. All this time both conductors were up; while *ships near, without conductors, received no injury.*"

"His Majesty's ship *Kent*, Capt. Rogers, was struck when in the Mediterranean; three men were killed, and several wounded, and the masts much damaged. All this time two conductors were up; and there were more than twenty sail of his Majesty's ships *in company, and near to the Kent, without conductors, none of which were injured.*

"Heckingham House, near Norwich, was set on fire and much damaged by a stroke of lightning, notwithstanding it was armed with eight of the largest and

as I have made the foundation of all my remarks, but says that my argument "should not operate against the use of conductors in this country," I shall commence my reply, by laying before your readers some phenomena of very recent occurrence, to confirm what I had stated in 1822 might take place, from improperly applying metallic attractors as protectors against a stroke of lightning.

I had stated that the hundreds of conductors, attached to spindles screwed into the masts of his Majesty's fleet, at Plymouth, for the purpose of experiment, would, at some time or other, attract and fix over that port and its neighbourhood a cloud heavily charged with electric fluid, and cause a discharge of the whole upon the fleet, by which it would be greatly damaged; that this, in all probability, would occur at the moment of firing a cannon, or a salute; that the cloud thus deprived of its superabundant electricity would fall down in rain, accompanied by whirlwinds, inundate the county, and cause unheard-of convulsions of nature; and that the churches at Plymouth would one day be knocked down about the ears of those who might be in them, provided the conductors were permitted to remain. Now, Mr. Editor, it appears to me rather surprising that such phenomena should have recently occurred in the town of Plymouth, and in France, to confirm my statements, as will be seen by the following

Extracts from the Public Papers.

The first of these extracts shows that conductors were placed as represented, by way of experiment. The second proves that the convulsion of nature was evidently caused by those conductors. The third, that a church was struck by lightning at Plymouth, and its large conductor broken in pieces.

1st. "A gentleman, now (1825) on the Continent, writes, that the whole country in the neighbourhood of Lausanne is undergoing a singular process, called *paragrêling*. The paragrêles consist of poles 40 feet high, placed 500 feet from each other, to which conductors are attached. Great ravages are frequently occasioned to the vineyards by hail-storms; and it is asserted that these conductors, by depriving the hail-clouds of their superabundant electricity, will cause their contents to descend either in snow or rain."—*Portsmouth Chronicle, June* 18, 1827.

2nd. "A terrible storm has devastated the country near Lausanne, in which some lives were lost. In the district of Geneva, the loss is estimated at 500,000 francs."—*Plymouth and Devonport Chronicle, Oct.* 4, 1824.

3rd. "Charles's Church was struck by lightning; the slate roof much injured; the conductor, from about a foot off the window of the tower nearly to the ground, was broken into short lengths, much blackened and bent; the door was burnt off the hinges. The fluid then passed through two or three graves; through the church-yard wall, which is two feet thick, two of the largest stones of which were thrown into the streets with great violence: it entered the pavement of the streets, tearing up the stones, and exhausted itself in a gutter."

I am, Sir,
Your humble Servant,
WM. PRINGLE GREEN.

No. 1, *James Street, Adelphi, June* 29, 1827.

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most approved conductors. This house had eight chimneys, to each of which a conductor was affixed, reaching four feet above the top of the chimney and down to the earth."—EDIT.

[Some parts of Mr. G.'s letter, which refer to certain attacks made upon him in the Devenport and Plymouth Chronicle, we have left out; conceiving that they could have been understood and appreciated by those alone who have seen these attacks; and that the journal which gave currency to them, is the fittest medium for his defence against them.]—EDIT.

TABLE OF HORSE POWER AT DIFFERENT RATES OF SPEED.

(*From the Treatise on Mechanics of the Library of Useful Knowledge*).

Let us suppose that the number 15 represents the greatest unloaded speed, and that the square of 15, or 225, represents the greatest load which can be sustained without moving. The signification of the units which compose the number 15, will be found by dividing the space through which the animal would move in a given time, suppose one hour, into 15 equal parts: each of these parts will be expressed by an unit of the number 15, which ex-

presses the greatest unloaded speed; and the signification of the units of 225 will be found by dividing the greatest load which can be sustained without moving into 225 equal parts: one of these parts will be expressed by an unit of the number 225, which expresses the greatest load. The following Table gives for each degree of speed from 1 to 15, the corresponding load and useful effect.

Speed . . .	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Load . . .	225	196	169	144	121	100	81	64	49	36	25	16	9	4	1	0
Useful effect	0	196	338	432	484	500	486	448	392	324	250	176	108	52	14	0

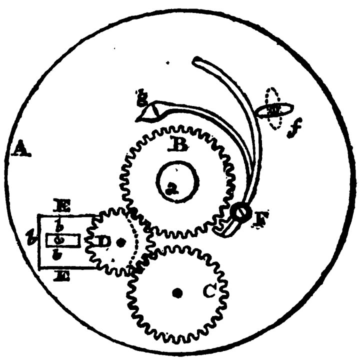
From the inspection of this Table, it appears that a much greater useful effect is to be attained by the slower motions with heavier loads, than by the quicker motions with lighter loads. The greatest useful effect is produced by the speed 5 with the load 100; that is, with a velocity which is one-third of the greatest unloaded speed, and a load which is four-ninths of the greatest load which can be sustained without moving. We shall find this result, whatever be the number we take, to represent the greatest speed.

Thus, if the greatest unloaded speed of a horse be 15 miles an hour, and that the greatest weight which he is capable of sustaining without moving be divided into 225 equal parts, his labour will be most advantageously employed if he be loaded with 100 of these parts, and travels at the rate of five miles per hour. If he be thus employed, it will be found that he will carry a greater weight through a given distance in a given time than under any other circumstances.

IBBETSON'S GEOMETRIC CHUCK.

Sir,—In No. 194 of the Mechanics' Magazine, for Saturday, May 12, 1827, at page 300, your correspondent, a "Would-be Turner," requests me to communicate, through the medium of your pages, the modification of my chuck, by which I produce the eccentric ornaments exhibited in No. 2 of my specimens, which were inserted in your Magazine for Saturday, December 30, 1826; and I trust the following description of the principle on which I arrange the machinery, to effect the eccentric performances of the chuck, will prove satisfactory.

Suppose the surface A to be the front face of the chuck, and that B C D are toothed wheels which act thereon. The wheel D is moveable by means of the sliding plate E E, and may be fixed, by the tightening screw and groove *b b b*, so as to act with the wheels B and C, or not, as required; when the wheel D is withdrawn from acting, the wheel B will remain at rest, although the wheel C may continue to revolve. The wheel B, when thus at rest, becomes available for the circular division of *eccentric work*. The click F is now to be brought into action on the wheel B, by placing the stop *f* in the direction of the dotted line, when the spring *g* will force the teeth of the click F into the teeth of the wheel

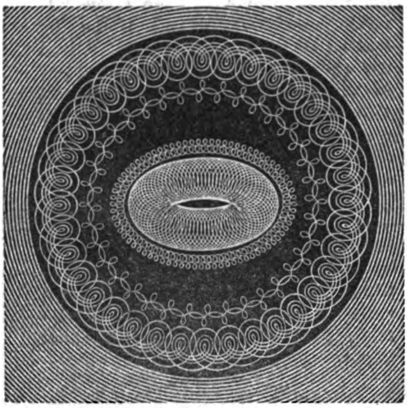


B, at any division of the circle required; the surface of the edge of the wheel B being divided, and the divisions distinguished by figures, on which the first tooth of the click F may be made to act as an index. In this situation of things, the geometric chuck assumes the *bonâ fide* character of the eccentric chuck; and will, consequently, as I stated

in my communication of the 30th of December, 1826, perform all the work of an eccentric chuck with the greatest possible degree of precision.

I will now present you with an engraving (on black African wood), which I have effected by my geometric chuck; and, in case you deem it worthy of finding a place in the pages of your publication, I shall receive pleasure by your so employing it.

This specimen is illustrative of a power of my chuck quite distinct from any which is comprehended in those inserted in your Magazine of



the 30th December last: it exhibits its power of throwing all the epicycloidal curves, and also all eccentric work, into an elliptical form, and of arranging the loops or circles, *in that form*, at equal distances. This power of equalizing the velocity of a point moving in the curve of an ellipsis is, I have every reason to consider, quite new; and I will submit it, as an arrangement of mechanical means or of moving powers, as a matter worthy the attention both of the mathematician and mechanic.

I am, Sir, &c. &c.

JOHN HOLT IBBETSON.

Smith-street, Chelsea,
June 27, 1827.

MORTAR COMPOSITION.

Authors differ very much concerning the proportion of lime and sand in the formation of mortar. Dr. Hawkins gives it 7 of sand to 1 of lime; the Domestic Encyclopædia of Willich, 3 of sand to 1 of lime. A new work called "The Builder's Pocket Manual," by G. A. Smeaton, says, that the mortar generally in use for common purposes, is about 1 bushel of sand to 1½ of lime, but that the workmen must judge from the quality of the lime the necessary proportion of sand (but *how* he does not say). How wide apart are all these quotations. Happening to peruse a French work on Domestic Economy, I find the rule to know the proper quantity of lime to mix with sand to make mortar. It is as follows: "To the quantity of sand you wish to make into mortar mix as much water as the sand will take up, hold, or contain, while in the heap; then mix as much lime with it as will bring it to the proper consistence." As this appears a very natural and easy mode of determining the proportions, and differs much from English authors, who greatly differ also from each other, I wish this may lead to a discussion, by some of your scientific correspondents, as to the chemical qualities and proper quanties of lime and sand for the best mortar.

Your's, &c.

WILDEN.

NOTICES TO CORRESPONDENTS.

The time required for working off a sufficient number of the Portrait of the King, which was promised to be given with the Supplement to Vol. VII., published this day, makes it necessary to postpone its appearance for one week. It will be given next Saturday, along with No. 205, which will contain, besides, three architectural views of the New Palace building on the site of Buckingham House, with a critical description.

Communications received from Mr. Utting.—5 P.—R. P. F.—B. H.—H. Hill—A Pedestrian.—Mr. Smithers.—W. H. A.—M. A. of Brazen-nose College.—Crank.—Keysoe.—Bolnhurst.—Investigator.—Rusticus.

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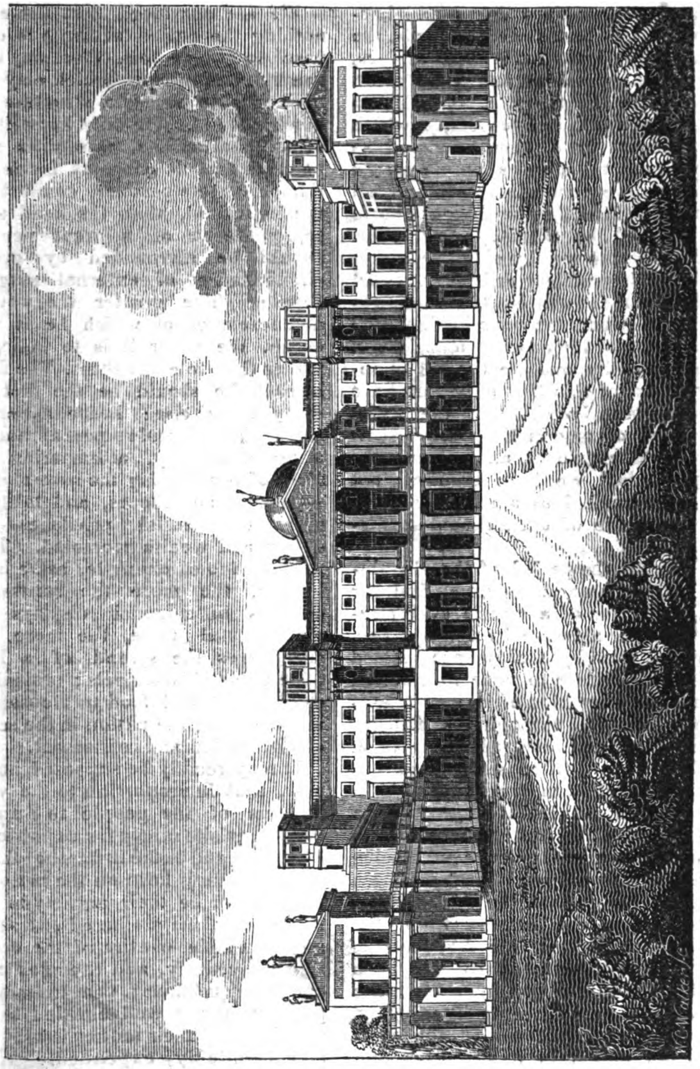
No. 205.] SATURDAY, JULY 28, 1827. [Price 3d.

NEW PALACE, ST. JAMES'S PARK.



NEW PALACE, ST. JAMES'S PARK.

Wealthier than any other people in the world, and as ambitious of national pre-eminence as any; proud to be thought the freest, the bravest, the greatest, and happiest of nations—to have the wisest laws, the most beneficent institutions, the most commodious docks and harbours, the best stored arsenals, the most spacious roads and bridges, the noblest towns and cities;—all this the English are, or wish to be; and yet in one respect, in which it might have been supposed so opulent and proud a people would have more particularly eclipsed all other nations, they have been hitherto surpassed by almost every other. *No palaces* worthy of notice, either for their grandeur or beauty, could Englishmen point out to the admiration of strangers; none half so good as many of the country mansions of our nobility and gentry. The sovereigns of this first of nations have long been confessedly the worst lodged of any in Europe. "Hospitals like palaces, and palaces like hospitals," we have been content to see ranked as among the most remarkable of our national distinctions.

About the period of the Revolution, there was a project on foot for the erection of a palace at Whitehall, after a design by Inigo Jones, which would probably have yielded in magnificence to none in Europe; but the execution of it was unhappily frustrated through the political troubles and contracted spirit of the times. Often since then has the subject been pressed on public attention; and had it not been for a succession of expensive wars in which we were engaged, some attempt would doubtless have been made, long before the present day, to redeem the country from the meanness of its royal residences reflects upon it. The recessation from hostilities which we are now happily enjoying, having at length turned the spirit of the nation in a strong current towards internal improvement, and vast sums having been expended in the architectural embellishment of the metropolis—in enriching it with new streets, and squares, and terraces, new churches, new bridges, and various other new public structures—a NEW PALACE begins at last to rear its head, as if intended to crown the triumphs of this era of peace and peaceful works.

We are convinced that there is nothing the nation at large is disposed to grudge less, than any expenditure of money which may be necessary to supply a structure so much wanted. He must know little of national affairs, who does not perceive that it concerns far more than the mere personal comfort of the individual, that the head and representative of a great people should be surrounded by every circumstance of external magnificence. The greater the power and resources of which he is the organ, the wiser it is to indicate rather than to exert them. The first in rank, he should be the first in every thing else: hence subordination at home and respect abroad—a useful nobility, attempering instead of overtopping the sovereignty—friendly neighbours, and faithful allies—commercial privileges—industry and wealth promoted. The fountain too of example, as he is of honour, the more the sovereign delights in splendid displays of architectural taste, the more he encourages the spread of a like taste among his subjects; providing employment and food to thousands, and elevating the nation in the scale of civilization and refinement.

It may readily be supposed, however, that in proportion to the willingness of the people to furnish every requisite supply for so patriotic a purpose, and to the influence which the result may have on the national taste, must be their anxiety to see this new palace produced on a scale and in a style worthy of the occasion, the country, and the age: nor can it be questioned, that those who pay for it are well entitled to be satisfied that their money is usefully and creditably expended. With the view of enabling that very considerable portion of them, who are

readers of the Mechanics' Magazine, to judge how far the edifice, so far at least as external structure is concerned, is likely to satisfy the expectations of the public, we now present them with three views of it, exceedingly well engraved by Mr. Walker, from drawings made by Mr. Davy, of whose abilities, as an architectural and mechanical draughtsman, our readers have had so many pleasing proofs.

The first view is of the public entrance-front, from what is called the Mall, in St. James's Park; the second of the palace as it appears from the Reservoir in Piccadilly; and the third, of the garden-front.

Of the site of this building, which is the first matter that claims our consideration, we fear nothing favourable can be said. "He that builds a fine house," says lord Bacon, "upon an ill seat, committeth himself to prison;" and even so, we apprehend, will the judicious grieve to say of his Majesty George the Fourth. In every thing which Mr. Loudon, the intelligent editor of the "Gardeners' Magazine," says on this subject, in the following extract from one of his recent numbers, we perfectly concur.—"Had the problem," he says, "been proposed (how) to alter Buckingham House and gardens, so as to render the former as unhealthy a dwelling as possible, it could not have been better solved than by the works now executed. The belt of trees, which forms the margin of these grounds, has long acted as the sides of a basin, or small valley, to retain the vapours which were collected within; and which, when the basin was full, could only flow out by the lower extremity, over the roofs of the stables and other buildings at the palace. What vapour did not escape in this manner, found its way through between the stems of the trees which adjoin these buildings, and through the palace windows. Now, all the leading improvements on the grounds have a direct tendency to increase this evil. They consist in thickening the marginal belts on both sides of the hollow with evergreens, to shut out London: in one place substituting for the belt an immense bank of earth,* to shut out the stables; and in the area of the grounds forming numerous flower-gardens, and other scenes with dug surfaces, a basin, fountains, and a lake of several acres. The effect of all this will be a more copious and rapid exhalation of moisture from the water, dug earth, and increased surface of foliage; and a more complete dam to prevent the escape of this moist atmosphere, otherwise than through the windows, or over the top of the palace. The garden may be considered as a pond brimful of fog, the ornamental water as the perpetual supply of this fog, the palace as a cascade which it flows over, and the windows as the sluices which it passes through. We defy any medical man, or meteorologist, to prove the contrary of what we assert, viz. that Buckingham Palace is a dam to a pond of watery vapour, and that the pond will always be filled with vapour to the level of the top of the dam. The only question is, how far this vapour is entitled to be called *malaria*. We have the misfortune to be able to answer that question experimentally. * * * * A man must be something less or more than a king, to keep his health in that palace for any length of time."

People in general are but little aware of the injurious effects of bodies of standing water on the salubrity of the surrounding atmosphere. Lord Bacon, who seems to have been inspired, as it were, with all the practical wisdom of many succeeding generations, has left some observations on the subject, which well deserved to have been honoured with more regard than they have experienced. "For fountains," he says, "they are a great beauty and refreshment; but *pools mar all, and make the garden unwholesome, and full of flies and frogs*. Fountains I intend to be of two natures: the one that sprinkleth or spouteth water; the other a full receipt of water

* Compared in some of the newspapers to a Westmoreland mountain!!!

of some thirty or forty feet square, *but without fish, or slime, or mud.* The main matter is to convey the water *as it never stay* either in the bowls or the cistern; that the water be *never by rest discoloured green or red, or the like;* besides that it is *to be cleaned every day* by the hand: also some steps up to it, and some fine pavement about it, do well." "The main point," as he again enjoins, is, "that the water be *in perpetual motion,* fed by a water higher than the pool, and delivered into it by fair spouts, and then discharged away under ground by some equality of bores, *that it stay little.*"*

To those who may want farther enlightening on the subject, we recommend an attentive perusal of an able paper *On Malaria,* by Dr. J. M'Culloch, in the last number of the Quarterly Journal of Science. Dr. M. shows, that the fevers so common in this country during the hot months from June to November, and which are popularly designated by the general term *typhus,* are all, most probably, the effects of *malaria* generated by the decomposition of vegetables in water; that, though it is commonly supposed that standing waters, when clear and free from smell, and all running waters, are perfectly salubrious, they may, in fact, be nearly as injurious as those that are putrid and stagnant; that, besides proper marshes, fresh and salt meadows, and wet pasture lands generally, all woods, coppices, thickets, rivers, lakes, ponds, *ornamental waters,* pools, ditches, *plashy and limited spots of ground generally,* &c., send forth more or less of this noxious vapour; that wherever, in short, any chemical compound of the vegetable elements is wetted, or held in solution by water, there the poison in question may be or, will be produced, *provided the temperature be sufficiently high;* that the smallest spot coming under any of the above denominations is sufficient to produce malaria, and *a single inspiration of that malaria to produce disease;* and that such marshy and watery spots have been known to extend their insalubrious influence to a distance of some miles. Dr. M. not only explains, on general philosophical principles, why such effects must necessarily be produced, but enforces his conclusions by numerous and unquestionable authorities. Volney observes of America, that there is not a river, valley, wood, mill-pond, meadow, or lake, throughout its whole extent, which does not (in hot weather) produce malaria; and that, in the whole course of his travels, he did not find a dozen houses without fevers. Monfalcon is equally decided as to the poisonous qualities of all such waters in France. There are extensive districts in that country occupied by ponds rather than lakes, maintained and farmed for an inland fishery, where the diseases from malaria prevail to such an extent, that the average of life does not exceed twenty years; where the people are decimated every year; where absolute old age, in those who survive so long, takes place at forty; and where the aspect of twenty is that of fifty or sixty in less unhealthy regions; where even the children are diseased from their births—becoming subject to unceasing fevers if they live to the age of seven, and thus continuing till death arrives to terminate the literally long disease of life. Monfalcon particularly condemns all canals, ponds, and *ornamental waters, of whatever description.* The canal at Versailles, and the similar piece of water at Chantilly, which are mere ponds, scarcely exceeding in size that in our St. James's-square, are the common causes of severe intermittent and remittent fevers. All the Italian writers agree that similar effects are produced in their country. "We need not, it is true," says Dr. M., "look for danger in a rapid stream, a northern climate, or a hilly region; but the Ouse, the Lea, (the Thames also?) and similar rivers, cannot possibly be exempt, unless England claims an exemption on some principle different from that which exists in France and Italy."

* Essay of Gardens.

"If any one," he adds, "will be at the trouble of examining the condition of health and the characters of the disorders; and further, the time of the year and the particular kind of seasons in which these prevail, as they relate to the inhabitants of such spots; more particularly, if he will compare the results with what occurs among the same classes of people in dry situations; I cannot doubt that he will everywhere find such proofs as I might easily have brought before him, did I not dislike to name the places.* Such are the houses of the opulent, in such districts as those which border the Thames, the Ouse, or other slow rivers; *houses where ornamental water has been introduced, and more especially where these are confined by woods*, (such exactly as Buckingham Palace); ancient castles surrounded by moats; and, among the poorer classes, those placed by canals, mill-ponds, and in other analogous places: to which I might add, what, however, is rare in our own country, if common on the continent of Europe, fortifications; the diseases of which, when the ditch is wet, are notorious every where: and to these I may subjoin, what will excite more surprise from their apparent insignificance, the ponds of gravel-pits; which will be very often found the causes of those fevers that occur in such situations. What will be observed in all such cases is, that the inhabitants, even where opulent, are subject to what is vaguely called ill health; while, to use a common if a vulgar phrase, they are places where "the apothecary is never out of the house." And this ill health, where least marked, will be found to consist in a succession of petty and almost indescribable fevers; being in reality the very condition which torments the inhabitants of the pestilential parts of France and Italy from their cradles to their graves, in a variety of painful disorders, including rheumatism and sciatica; and in what, if difficult to ascertain absolutely, is well known to those familiar with Italy and France—namely, visceral obstructions and very particularly disordered spleen—well marked, to those who know these countries, in the peculiarly sullen complexions and physiognomies of the individuals."

It is, after all, however, but fair to observe, that the malaria in question is not a nuisance of all times and seasons; but is stated positively to be generated "*only in hot weather*." There is a cogency in this consideration which Mr. Loudon appears to have overlooked; for though Buckingham Palace may be a most unhealthy residence in the dog-days, may not the owner of it say as Lucullus did to Pompey—"Do you think me so little wiser than some fools are, as not to change my abode as the seasons change?" As a winter residence, for which purpose, indeed it is chiefly designed, Buckingham Palace may still be nearly as healthy as any other.

Still, it is much to be regretted, that when a new palace was to be erected at a vast expense, some site was not chosen for it which would have been equally healthy at all times. Mr. Loudon suggests "the circular part of the Regent's Park, or, what is *naturally* the best situation about London, though *accidentally* the worst, Greenwich Park." A situation not much inferior to either, would have been the elevated part of the Green Park, in front of the Reservoir, Piccadilly; supposing that reservoir to be removed, and the adjacent grounds enlarged by taking in part of Buckingham Gardens—the rest being thrown open to the public in lieu of the Green Park, of which they would have been thus deprived.

Of the *architectural* merits of the building of which we come now to speak, opinions will be various, according to the point from which

* Why Dr. M. should have observed any delicacy in this respect, we do not understand. What but good to the public could he have done, by denouncing at once the whole of the ponds in St. James's Park, the Green Park, Hyde Park, Kensington Gardens, and the Regent's Park, as pestilential nuisances to all around them?

it is viewed. The first of our engravings exhibits the grand entrance-front, and to that we shall first turn our attention.

On approaching the Palace from the Mall in the Park, the universal sentiment must, we think, be one of great disappointment; if you happen to have some little taste, one also of considerable disgust. There is nothing either of unity, grandeur, or elegance, in the impression which it produces; you see only a jumble of odd and insignificant and discordant details: a centre without breadth, and of two different orders ill combined; low, projecting, wings, broken into petty and unequal masses; a profusion of little turrets, like those of a floor-cloth manufactory, and little chimneys, like ships' windlasses; the whole surmounted by what was intended for a stately dome, but which our correspondent, Mr. Davy, has more fitly likened to "a Brobdignagian egg;" placed, we would add, rather awry in its cup.

A harmonious union of any two of the Greek orders in one elevation, has never been a thing of easy accomplishment; but seldom has it been attempted with worse effect than here. The architecture of the ground story is Doric; but you at once miss the distinguishing characteristics of this most natural and magnificent of the Greek orders. The columns are merely surmounted by what is termed "an architrave cornice," with the mutules; while the frieze, with its elegant accompaniments—the triglyphs and metopes—is altogether omitted. The insertion of an entablature of so large and massive a character as the Doric, in its entire state, would, it is true, have occupied too large a space between the two stories, and have had a depreciating effect on the Corinthian order raised above it; but this only shows the impropriety of attempting any junction of two orders, when it is necessary for the purpose that one of them should be shorn of its principal ornaments. It has been supposed, and with some show of reason, that the apparent neglect of the Grecian style by some of our older architects, was not owing to any insensibility to its merits, but to a conviction of the impracticability of introducing it of two heights, except by means of some such absurd mutilations and conjunctions as Buckingham Palace now unfortunately exhibits. Sir Christopher Wren, to avoid the incongruity of raising a modern tower on a Grecian portico, was in the habit of projecting the former from the body of the church; and, though this has given occasion for a complaint, frequently made, that the towers of most of our metropolitan churches seem to rest on the roof, it is worth considering whether a much greater blemish has not by this means been avoided. The great western portico of St. Paul's was originally designed, by Wren, of one height; but he was overruled in the execution of it, and obliged to alter it to the compound, though still beautiful, thing it is. Inigo Jones, in the design for a palace to which we before alluded, steered clear of all such anomalies, by adopting the Roman style exclusively; and it would have been well if the designer of the present Buckingham Palace had only been content to copy after him.

Of the second story, of the Corinthian order, we are happy to be able to speak in more favourable terms. The fluted columns have a disproportionately slender appearance, when contrasted with the massive shafts beneath them; but the frieze here is preserved entire, and deserving of every praise for the tasteful and emblematical character of its embellishments. In the centre is the British crown, surrounded with laurel, amidst the leaves of which the Rose, the Thistle, and Shamrock, alternately present their claims to share in the honour of having thus encircled the nation's diadem.

Of the two wings it is impossible to speak but in terms of utter condemnation. Defective as the centre is, the projection of these paltry excrescences makes it look a great deal worse than it would otherwise have done. They serve only to darken and diminish; and consist-

ing, besides, of but a superior order of offices, are objectionable for this farther reason, that they overlook the principal windows of the mansion, to which they should have been kept wholly subordinate.

As to the dome, again, or "Brobdignagian egg," who can look on it but in derision and contempt? View it from where you will, on the eastern side, it appears ludicrously diminutive; and from every spot except that directly in front, it groups so obliquely with the other parts of the building, as to offend even the most unpractised eye. It has, in fact, nothing at all to do there; it belongs to the back part of the palace [See our third engraving], and should have been screened from the sight in front entirely (a task of no difficulty to any architect acquainted with the resources of his profession).

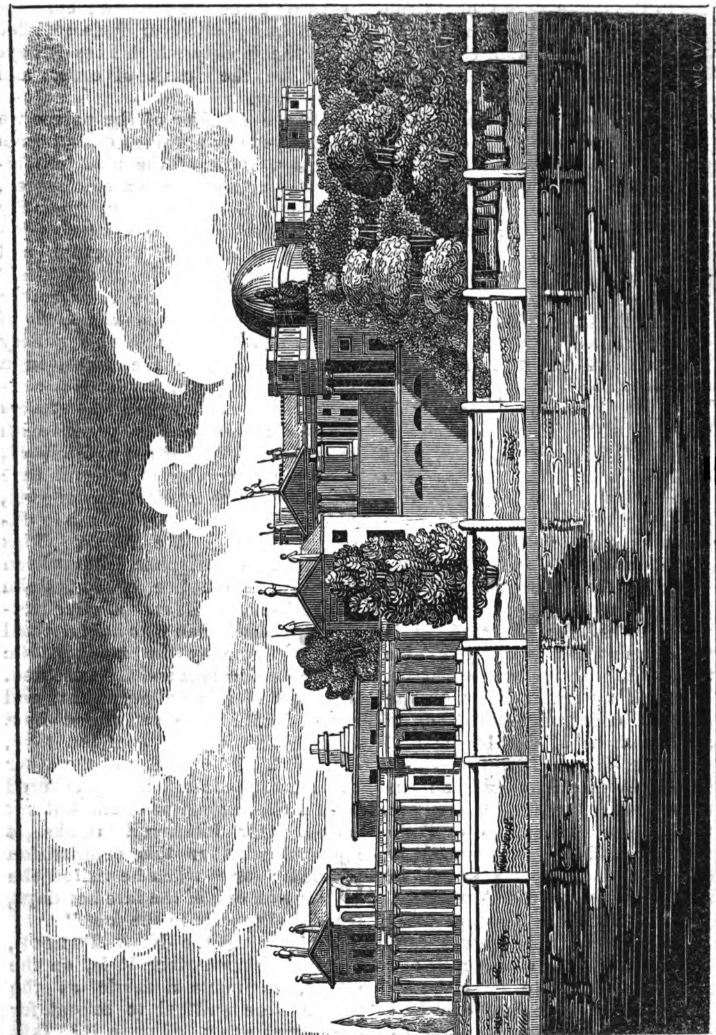
The view from the Reservoir in Piccadilly, which forms the second of our engravings, embracing, as it does, little more than the eastern front, which we have just been criticising, suggests, of course, the same objections; a little softened only by distance, and no ways atoned for by any newly-developed magnificence of effect.

The view of the garden-front is the only one which is likely to give undivided satisfaction to an observer. It presents an upper story, of the Corinthian order, supported on a rustic basement of the Ionic; and though the latter, like the Doric basement in front, has only an architrave cornice, yet, in consequence of the parts omitted being of little importance, and the character of the Ionic order more nearly allied, in point of delicacy, to the Corinthian, the construction is altogether tolerably harmonious. The masses, too, as Mr. Loudon observes, are "simple, and easy to be comprehended, and yet sufficiently enriched in detail, to mark the building as an abode destined for splendid enjoyment." There is no multiplicity of jarring parts—no projecting wings or arms—no crowding or confusion. The garden-front fills you with pleasure, because it is in most respects precisely the opposite of the grand entrance-front. It makes its impression at once, and irresistibly; it tells by the instantaneous effect it produces—not by the criticism which it provokes; you seek not for reasons why you are pleased; even the most hasty observer feels satisfied that the beauty which fixes his eye must be the result of order and simplicity.

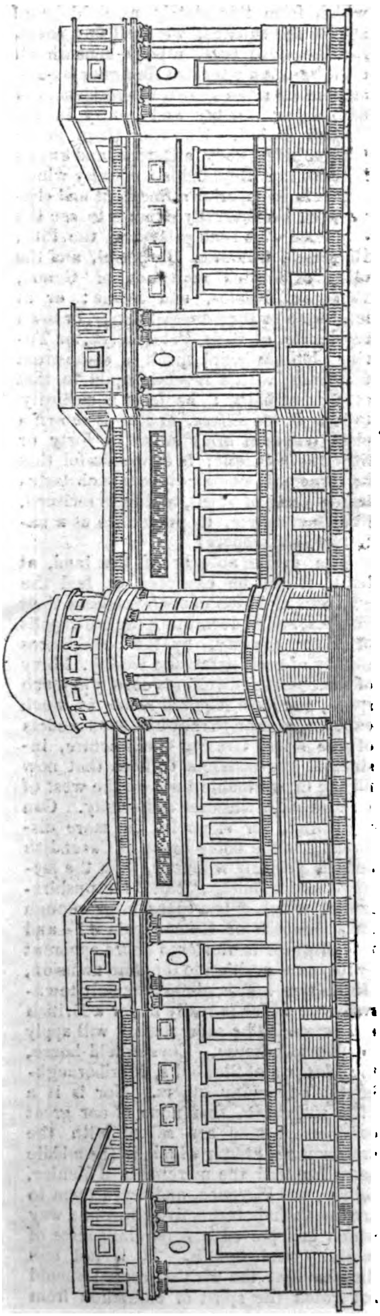
Of the *interior* of the palace we can as yet say nothing, except from hearsay. One of the most magnificent apartments, we are informed, will be a picture gallery, "worthy of a monarch who has been avowedly a munificent supporter and encourager of the arts and sciences." (Pity that the external architecture should not have been *as worthy* of him!) The light into this gallery is admitted from the sides, in a slanting direction, by metal skylights. The ceiling has iron girders thrown across, and is arched with combs, each having the ends closed, with the exception of a small hole (exactly like an inverted flower-pot), which admits a current of air to circulate through the floors. This excellent contrivance has been brought into notice by Mr. John Richardson, builder, of Spencer-street, a gentleman who has acquired merited fame by the many public works he has successfully executed. The roof of this gallery is flat, and covered with slate embedded in a composition of hot coal-tar, lime, and sand. The roofing of the other parts of the palace is mostly covered with a similar composition, but *not* slated. Our informant thinks it doubtful whether this composition will last; for "when he visited the building on one of the late hot days, it yielded readily to the foot."

Such being the NEW PALACE, may we ask, whether it is, on the whole, as noble a fabric as the people were entitled to expect for the money expended upon it? Is it one which will do honour to the age in which it was erected?—one which an Englishman will feel pride in pointing out as a monument of the munificence and taste of his country?—Every one of these ques-

tions must, we fear, be answered decidedly in the negative. To say nothing of its unhealthy situation, the only part of the exterior which can be looked upon with any satisfaction, is that which it is most difficult to get a sight of; while the grand entrance-front, which is exposed to the universal gaze, is scarcely worth looking at. Had we jurisdiction in the matter, we would order the whole of the entrance-



front to be done over again, and the vile wings to be *entirely* swept away; the gardens should also be cleared of their pestilential pools, or such an active circulation given to the waters, as would exclude the possibility of their generating, at the worst, more than simple damp. As it is, Buckingham Palace still leaves us as we were—without a



single royal residence worthy of the rank of England in the scale of nations.

Who the designer of this building is, has hitherto remained a secret; nor do we suppose he will be very desirous of having the cloud removed, for the sake of the solitary honour which the garden front may confer upon him. The popular voice has singled out Mr. Nash as the most likely person to be the author of this abortion (from his connexions with royalty); but it is due to him to state, that he has disclaimed having any share in its production.

ARCHITECTURE OF THE METROPOLIS,

[*Abstracted from a Paper read by Mr. Merrit, before the Literary and Philosophical Society of Liverpool.*]

Being unquestionably the richest, largest, and most populous city of Europe; the seat of a wealthier court, and a more opulent body of nobility and gentry, than any other metropolis; it seems only a natural and reasonable expectation that it should likewise excel all others in the number and magnificence of its public edifices and private dwellings; in its general elegancies and accommodations as a city; and in all the appendages and decorations which naturally accompany so manifest a superiority. But this is very far from being the case, and our striking deficiencies in these points afford matter for one of the severest of our national reproaches. An overgrown capital is essentially a great evil, as it is the natural confluence of the worst species of misery, corruption, and crime. It brings together the greatest extremes of luxury and poverty, of rudeness and refinement. The natural, though insufficient compensation for these excesses, is sought for in the splendour of its decorations, and the superiority to which the ornamental arts of life may there be expected to attain. The art of architecture especially, the only one of the arts which requires great wealth for its successful prosecution, may there be expected to rear its head in proud pre-eminence; but the enlightened traveller, who comes to London with this very justifiable prepossession, will find himself miserably disappointed. Till within the last few years, that most splendid and impressive of all the arts has been almost wholly

neglected, and the extension and improvement of the capital was left in the hands of sordid ignorance and barbarous caprice.

So much for the general view of the subject: I shall now beg leave to descend to a few more minute particulars.

The great architectural superiority of London, such as it is, consists in the number, size, and general neatness of its principal streets and squares. No other city can boast so great a number of streets, equal to those of London in length and breadth, and so uniformly well built. 'Petersburgh, Berlin, Naples, Turin, Genoa, Antwerp, Edinburgh, and other places, have perhaps finer streets than any in London, but in respect to their number there is no comparison. At present, also, it may be affirmed, that since the completion of the line of street extending from Carlton-house to the Regent's-park, it would not be easy to find, in any other city, even a single street which greatly exceeds that magnificent range of buildings.

Remarks of a similar kind may be applied to the squares. If we assent to the critical canons established on this point, that architectural beauty is constituted by a variety amidst uniformity, and that in every regular figure the subordinate parts should bear a certain proportion to each other, it will be found that every square in London is manifestly imperfect. There is none that can be compared with the great square of St. Petersburgh, the *Place Vendôme* at Paris, the *Place Royale* at Brussels, the *Place* of *St. Marc* at Venice, or even with the principal squares in Edinburgh. Yet, when we consider their number, their spaciousness, their enclosures, and their general neatness, they form altogether such an assemblage as no other city can rival. The new squares, such as Bryanstone, Torrington, Bedford, Russell, &c., are tolerably uniform; but they want variety and architectural decorations in their constituent parts. The old, such as Grosvenor, Portman, St. James's, &c., have sufficient variety in parts; but having neither uniformity nor proportion in their whole, nor much beauty in their details, their pretensions are still less. Fitzroy, Tavistock, Belgrave, and Regent Squares, if completed on their respective plans, as far as they are at present developed, will comprise most of the requisites of a handsome square, though not without considerable faults.

If we descend from these general features, to the individual mansions which form this stately assemblage of streets and squares, we shall find them, for the most part, utterly beneath all criticism. An educated foreigner is quite astonished when shown the residences of our higher nobility and gentry in the British capital. Knowing them to be the wealthiest body in Europe, and knowing also that England is a country which pretends to superior refinement and civilization, he naturally expects to see the city filled with such palaces as the Pitti, Borghese, Colonna, Barberini, and the other celebrated mansions of Genoa, Florence, Naples, and Rome; or at least such as the principal *hotels*, or town residences, of Paris, Petersburgh, or Turin. He has heard speak of some great nobleman, with a revenue equal to that of a principality: he feels a curiosity to look at his *palace*, and he is shown a plain common brick house of forty or fifty feet in extent! Is it wonderful that he turns with contempt from such tasteless poverty of spirit, and feels inclined, like Buonaparte, to pronounce us a nation of shopkeepers?

The prime nobility of the land, at least, might be expected to feel the generous ambition of distinguishing their families, and of decorating the metropolis of their country, by town-residences worthy of their name and wealth. Many of their present dwellings occupy as much space, and have required nearly as much expense, as though they had been models of the finest Grecian architecture, instead of the tasteless edifices that now fill the interminable lines of the west of London with tiresome uniformity. Can any thing, for example, be more disgraceful to the noble house of Cavendish and its princely revenues, than the factory-looking building, called Devonshire-house, which fills a space large enough for a Genoese or Roman palace?—and this disgrace is rendered more apparent by its juxta-position to that fine mansion, Burlington-house, almost the only town-residence which is really fit for a British nobleman. The same remark will apply to Norfolk-house, Chesterfield-house, the Marquis of Stafford's, Marlborough-house, and many others. Nor is it a little surprising, that none of our great commercial men are seized with the architectural ardour which, in the middle ages, inspired the merchants of Venice, Genoa, and Florence, and urged them to ornament their respective cities in a way which has proved a perennial source of celebrity and wealth. It is not less singular that the British capital should not catch the spirit of emulation from

the sister-capital of Scotland, which contains but few nobility or opulent gentry, and scarcely any great merchants or manufacturers, and which, nevertheless, in the opinion of many travellers, is actually the finest city in modern Europe.

In the capital article of churches, London will probably be admitted, after Rome, to take the first rank amongst the cities of Europe. Some few places, as Milan, Strasburgh, York, &c., may boast a finer Gothic cathedral than Westminster; and St. Paul's must yield the palm to St. Peter's, as a Grecian temple; but no single city can boast *two* several specimens which rank so high in their respective departments. In churches of the secondary order, London is also richer than any other city. Many of these are undoubtedly very handsome; but the design for which they are built, that of containing as large a congregation as possible, has created an uniformity of structure very wearisome to the eye. They consist mostly of a plain oblong building, with a tall and slender steeple at one end, surmounted by a spire, and supported by a bold and handsome Corinthian or Ionic portico or peristyle; but the remainder of the church being generally destitute of all architectural ornament, a striking appearance of incongruity obtrudes itself on the spectator. This is greatly relieved; when, as in the fine church of St. Martin's-in-the-Fields, the body of the church is sustained by semi-columns or pilasters, and their proper entablature; but this is seldom attempted. The new church in Langham-place has a beautiful portico in the form of a hexastyle; and, though that structure is liable to much censure, yet the attempt at variety which appears throughout the whole design is spirited and laudable.

We come next to the article of bridges; and, in this particular, it must be admitted that no city in Europe can pretend to any competition with London. No other great capital is, indeed, so favourably situated in this respect, bisected as it is by a broad and deep river which bears on its current a greater commerce than any yet known in the annals of mankind. The Seine at Paris is very complete in its bridges, both as to quality and number; but the narrowness of the river is a bar to all magnificence. The bridge over the Garonne at Bordeaux is, perhaps, of greater extent, and that over the Elbe at Dresden is more finely ornamented, than any in London; but no single city can show five such bridges as those of Westminster, Waterloo, Blackfriars, Southwark, and London.

In its general public buildings, under which may be included every public edifice not comprehended under the heads of churches, palaces, or bridges, London, considering its vast extent, is certainly not pre-eminent, though it is by no means so strikingly deficient as some have supposed. It is a great disadvantage to the English metropolis, that its principal edifices are scattered over such a vast extent of surface—that they present an appearance of paucity much beyond the reality. The Custom-house, the New Post-office, the Mint, the Royal Exchange, the Bank, Somerset-house, the New Treasury, the Opera-house, and many others that need not be enumerated, would form a magnificent assemblage, if they were grouped nearly together, and could be viewed with little intermission of space and time. The two national hospitals of Greenwich and Chelsea, may also be considered as belonging to London, and they form a noble appendage to its catalogue of public edifices. Greenwich Hospital may, perhaps, be pronounced, without exception, the finest *profane* building (using that term in contradistinction to *sacred*) in modern Europe; and that of Chelsea, though deformed by the barbarous mixture of stone and brick, which was so much in fashion in the earlier part of the seventeenth century, has an air of sedate grandeur which is very impressive.

It is much to be lamented that the fire of London did not happen under the reign of George IV. Under the influence of modern taste, the whole city would have risen from her ashes with a splendour and magnitude which would have astonished the world, and attracted the curious traveller from the remotest regions. She is now too old and unwieldy to expect any effectual cure of her complicated maladies, but her constitution is in a course of gradual improvement. The passion for architectural decoration has happily acquired all the dominant power of fashion, so that no extensive plan of building is now undertaken, in any principal part of the town, without some regard to external appearance. If this sudden fashion should happily not pass away with other ephemeral caprices, we may expect, in the course of a few years, to see the time arrive when an Englishman need not feel a sense of shame whilst conducting a stranger through the capital of his country.

SCOTTISH LIME-KILNS.

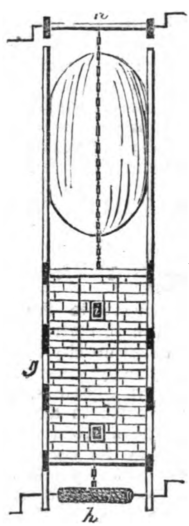
In our 7th Vol. p. 177, we gave an account of the Yorkshire mode of constructing kilns for burning lime with coal or coke; and we now extract from that excellent contemporary publication, the "Gardeners' Magazine," the substance of a paper by C. J. Stuart Menteath, Esq. of Closeburn, Dumfriesshire, in which he gives the results of a very extensive experience in the quarrying and burning of lime.

Lime will in all cases be most economically burned by fuel which produces little or no smoke, because the necessary mixture of the fuel with the broken limestone renders it impossible to bring it in contact with a red heat which may ignite the smoke. Dry fuel must also in all cases be more advantageous than moist fuel, because in the latter case a certain quantity of heat is lost in expelling the moisture in the form of vapour or smoke.

Booker's Kiln. — Mr. Menteath thinks this the best of all forms that have hitherto been brought into notice for burning lime with coke or other dry smokeless fuel. The kiln of this description at Closeburn is built on the side of a bank; it is circular within—thirty-two feet high from the furnace—three feet diameter at top and bottom, and seven feet diameter at eighteen feet from the bottom; it has cast iron doors to the fuel-chamber and ash-pit, and a cast iron cap or cover, which turns on a pivot, and rests on a curb ring fixed on the top of the masonry of the kiln. The use of this cover is to prevent the escape of more heat than is necessary to keep the fuel burning; for which last purpose the cover has only an opening at top twelve inches in diameter. The principal advantage of this construction is, that very little heat is lost, and that lime may be burned with almost as little fuel in winter as in summer; another advantage, and one of considerable importance where a kiln is not worked sometimes for two or three days together, is, that by closing the orifice at top, and the furnace-doors below, the fire may be kept alive for four or five days. In the ordinary description of kilns, without covers, the fire is usually extinguished in twenty-four hours, especially in the winter season. In Booker's kiln, one measure of coke will burn four measures of limestone.

"The fuel for the lime-kilns at Closeburn is brought from a distance of twenty-five miles, and it is found that one-third of the expense of carriage is saved by coking it *at the coal-pits.* A measure of this coke burns as much lime as the same measure of coal; as, when coal is used at the lime-kiln, it may be said to be coked before it has much effect on the limestone. One of Booker's kilns, when coke is used, yields nearly three-fourths of its contents of well-burned lime every day.

When lime has to be burned with *coal* or other *smoky* fuel, Mr. Menteath has invented a form of kiln which he finds to be much superior to those in common use. It is built in a similar situation to the Booker's kiln—is of an oval form, and thirty-five feet in height; the diameter at the bottom, next the fuel-chamber, is only twenty-two inches; but gradually extends, till, at the height of twenty feet, it is five feet; which dimension is continued to the top, where the oval is nine feet by five. There is an *arched* cover to the top (as represented in the subjoined figure), which moves on small wheels, is drawn off and on by windlasses *h h,* and has two small openings, serving as chimneys for the exit of the smoke, *i i.*



As the fuel-chamber to this kiln is very broad in proportion to its depth, three separate doors or openings are found necessary, as well as advantageous for more speedily and easily drawing out the lime. In some cases, instead of a moveable cover, a permanent roof of ma-

sonry may be adopted, which should have proper openings to admit the supply of lime and fuel (closed by sliding shutters, or hinged doors), while on the roof there should be a chimney for the escape of the smoke.

The chief use of a lever, whether fixed or moveable, is, of course, to retain the heat; but where it is a fixed structure, and sufficiently large, something will be gained by placing the fuel and limestones there to be dried and heated before they are thrown inte the kiln.

Three-fifths of the contents of the Closeburn oval kiln may be drawn out every day; and when it is closed at top and bottom, the fire will not go out for five or six days.

HARMONY OF THE SPHERES.

Sir,—I have transmitted you a few remarks on a planetary analogy, for insertion in your valuable work, should they meet your approbation, in addition to what you inserted in Vol. VI. page 32; viz. If the mean distance of each planet from the sun be multiplied by the square root of its mean distance* respectively; and if this result be multiplied by its annual sidereal motion in longitude, and the product be divided by the sun's attractive power, a constant quantity will be obtained for each planet equal to *unity*.

The same analogy obtains in each respective system of satellites, producing a constant quantity for each system; and, if this quantity be divided by the square root of the mass, or attractive power of its primary, as compared with that of the sun, a constant product will be obtained, also equal to unity, as in the planetary motions.

Example.

Put V, V', V'' = sidereal motion of the planets in longitude;
v, v', v'' = sidereal motion in longitude of their respective satellites;
D, D', D'' = distance of the planets from the sun;
d, d', d'' = distance of the satellites from their respective primaries;
M, M', M'' = mass or attractive power of the sun;
m, m', m'' = mass or attractive power of each planet respectively:

whence $\frac{V\times D\times\sqrt{D}}{\sqrt{M}} = \frac{V'\times D'\times\sqrt{D'}}{\sqrt{M'}} = \frac{V''\times D''\times\sqrt{D''}}{\sqrt{M''}}$, &c. = unity;

also, $\frac{v\times d\times\sqrt{d}}{\sqrt{m}} = \frac{v'\times d'\times\sqrt{d'}}{\sqrt{m'}} = \frac{v''\times d''\times\sqrt{d''}}{\sqrt{m''}}$, &c. = unity, as before.

The annual sidereal motion of the earth in longitude, the earth's distance from the sun, and the sun's attractive power, are each taken equal to unity in the above formula. But if any other planet is substituted for that of the earth, the constant quantity thus obtained will always be equal to unity for each planet respectively.

And, as it has been demonstrated by *La Grange*, that the major axis of a planet's orbit, and its periodic time, are invariable quantities, it therefore follows that the *resultant* from the above formula is not only *constant* for all the planets, but a *constant quantity*, which will for ever remain invariably the same, according to the present existing laws of the universe!

Projecting and Gravitating Forces.

The *ratio* of the projectile and gravitating forces of a superior planet, is equal to that of an inferior multiplied by the *third power* of the $\frac{\text{ratio of their periodic times,}}{\text{ratio of their mean distances,}}$ directly.

The *ratio* of the projectile forces of any two planets is constantly equal to the *fourth root* of the *ratio* of their gravitating forces, or versed sines of their orbicular motions; and which *ratio* is also equal to the $\frac{\text{ratio of their periodic times,}}{\text{ratio of their mean distances,}}$ inversely. Or, the *fourth power* of the *ratio* of the projectile forces of any two planets is constantly equal to the *ratio* of their gravitating forces.

If the *ratio* of the projectile and gravitating forces of the several planets be divided by their periodic times respectively, a constant result will be obtained in the case of all

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* The proportional distance of any planet from the sun, multiplied by its square root, is equal to the periodic time of that planet, in sidereal years.

the planets: the same analogy obtains in their rotary motions, substituting the *arc* of their rotary motions, and its *versed sine*, for the projectile and gravitating forces. In fact, this law obtains in all bodies revolving in circular orbits, and in all rotary motions of bodies, from the orbicular and rotary motions of a planet to that of a wheel on its axis.*

I am, Sir,
Your's respectfully,
J. UTTING.

Lynn Regis, July 6, 1827.

P.S.—It is evident, from what has been stated above, that having the constant quantity given, it is easy, by inverting the process, to obtain the distance of any satellite from its primary, independent of its angular distance.

In Vol. VI. page 32, the *constant quantity* is given equal to 15634588170 miles: if this *constant quantity* be divided by the sq. root of the sun's attractive power, as compared with the earth, the quotient will be 26928100 miles, the constant product for the earth's satellite; whence it is easily found, that the moon's distance from the earth is 239780 miles. Had the earth's distance from the sun been taken = unity, as in the above formula, the moon's distance would have been given in radii of the earth's orbit, instead of miles.

In a similar manner may the distances of all the satellites from their primaries be ascertained; the accuracy of the result depending on the correctness of the distance from the sun—the periodical times of the planets and satellites being known to a sufficient degree of accuracy for this purpose. This method of ascertaining the distances of the satellites from their primaries is by far more correct than the usual method employed, viz. by computations made from their observed angular distances from their primaries.

The mass or attractive powers of the planets would also be had more correctly, if computed from the above distances.

Had the above laws or analogies been known before I published them, why was not this method employed in finding the distances of the satellites from their respective primaries, instead of the less correct method above alluded to?

J. U.

* For an elegant demonstration of the above law, I am indebted to P. Barlow, Esq., of the Royal Military Academy, Woolwich.

CURIOUS ARITHMETICAL CASE.

Mr. Editor,—As the following ancient and curious Arithmetical Question has not appeared in your entertaining miscellany, I have sent it for your insertion, should you think it worthy a place.

KEYSOE.

In an Arabian manuscript was found this remarkable decision of a dispute.—Two Arabians sat down to dinner; one had 5 loaves, the other 3. A stranger passing by, asked permission to eat with them; to which they agreed. The stranger dined, laid down 8 pieces of money, and departed.

The proprietor of the 5 loaves took up 5 pieces, and left 3 for the other, who objected, and insisted for one half. The cause came before Ali, the magistrate, who gave the following judgment:—

"Let the owner of the 5 loaves have 7 pieces of money, and the owner of the 3 loaves 1."—Query the justice of this sentence?

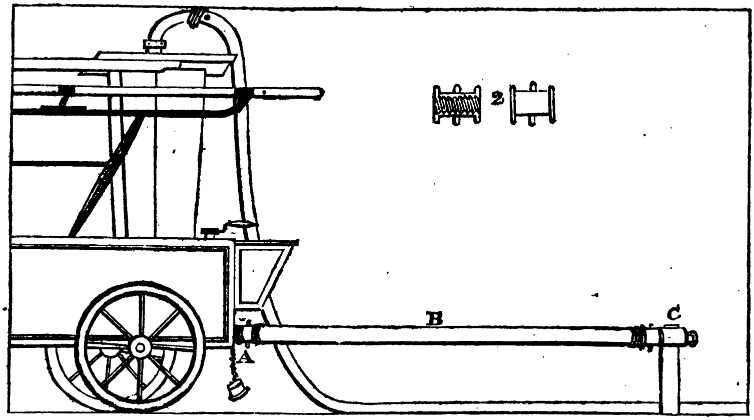
NETTLE STINGS.

Mr. Editor,—I perceive that attention has been paid in your useful work to cures for ague, wasp-stings, &c.; but there is one annoyance much more common in the country, especially to those who have quickset fences to their gardens, or premises, which is the stinging-nettle. In endeavouring to eradicate its sting, the pain is very great, and the skin is blistered, and so continues some days, though the smart generally goes off the first day. I

trust some of your humane readers will give, in your universal miscellany, a cure, or something to abate the poignant inflammation caused by this tormenting enemy to every countryman, particularly to your constant reader,

RUSTICUS.

METHOD OF OBTAINING A SUPPLY OF WATER AT FIRES.



Sir,—On Friday morning, June 15, Whitechapel furnished another melancholy proof—if proof, indeed, were wanting—of the inefficiency of the present method of supplying water in case of fire. Any contrivance, therefore, by which this dreadful calamity can even in the slightest degree be overcome, is worthy the attention of the public.

I have myself contrived several plans for the use of fire-engines, (which, with your permission, I will shortly lay before your readers); but they are all upon the supposition that water is plentifully obtained: until, however, the present system is very materially altered, any thing of this kind is of secondary importance.

The present communication is particularly addressed to persons entrusted with the care of private or parish engines; and is a practical method of obtaining water, at times when, under ordinary circumstances, there is no prospect of such a supply. It is the invention of Mr. Samuel Buston, the highly-respected fireman of the London Assurance Corporation, who, by his close attention to the subject, has brought the fire-engine, in its equipment and management, to great perfection; and were I asked by any person, where they might inspect one of these machines in its *most complete state*, I should, without hesitation (and I mean no disrespect to other similar establishments), refer them to the Company's engine-house in Bishopsgate-street. The method, which I will now describe, will be easily understood by referring to the above sketch, where an engine is shown at work on this plan. B, the section or suction-pipe (for it is indifferently written either way), is screwed to the hinder part of the cistern, at A, as usual. Instead of a rose or drain at the other end, screw on the brass stand-cock C. The plug having been opened, and the water not rising in it, or rising so scantily as not to keep the engine at work, put down the stand-cock, and drive it firmly into the service-pipe. The engine being worked, it will, if in good order, and the suction-pipe is air-tight, by its exhaustion, raise up and furnish itself with a copious supply of water; which, speedily obtained and applied with judgment, will, nine times out of ten,

supersede any farther assistance. As the screws at the end of the section-pipe and stand-cock are both male, a double female screw is necessary to effect the junction: one is shown at 2, and is a very useful article for fire-engines in general.

I remain, with respect,
Yours obliged,
WM. BADDELEY, Jun.
June 19, 1827,
10, *George Yard, Lombard-street.*

PROPELLING OF BOATS.

Sir,—As I have by me a small model of a plan for propelling boats, &c., by steam, or human power, I should feel obliged if any of your numerous readers would inform me where I can obtain information as to the various plans which at different times have been proposed for that purpose.

I have been able to see "Buchanan on Propelling Vessels by Steam." He refers to a number of models in the "French Society of Arts," and gives drawings of them. Steele, in his "Naval Architecture," has several plans of propelling vessels. There are, also, several in "Gower's Seamanship." I have mentioned these works, that your correspondents may know what works I have seen on the subject.

My plan appears to possess the advantage of giving the whole power of the engine, or first mover, to the vessel; but, as I have not tried it in a boat, I will not affirm positively that it will do so.

Should I find that a similar plan has been tried and failed, I shall not think it worth pursuing farther; but if, as I expect is the case, it has not yet been attempted, I shall probably be induced to try its effect—and should be even disposed to secure it by patent, but for the insecurity of patent property.

Your's obediently,
GEORGE BAYLEY.

HUMAN HAIR.

Sir,—Being a constant reader of the Mechanics' Magazine, though belonging to a profession that it rarely, if ever mentions, I was surprised to find in the last number an article under the head of "Human Hair."

The singular property, which Dr. Goring seems so much surprised at, is the *test* by which the hair preparers can alone distinguish the roots from the points, and which has been known ever since hair has been prepared.

Very few have a knowledge of the immense quantities of human hair that is prepared in London in a week, and which must be carefully selected, particularly keeping the roots and points from each other. If they become mixed, when made into articles for wear, the whole soon becomes matted. In order, therefore, to prevent this taking place, the preparer, if he have any doubt upon it, places the hair between his thumb and fore-finger, and by rubbing them together can always tell; the roots going from his hand, and the points coming into it.

I am, Sir,
Your most obedient Servant,
A HAIR DRESSER.
July 24, 1827.

NOTICES TO CORRESPONDENTS.

Communications received from G. B.—Somebody Else—Mr. Shires—T. T.—Q.—Globosum—A Crippled Mechanic—Mr. Baddeley—H. $\sqrt{\left(a\frac{2a2}{2}\right)}$ H. An Amateur Mechanic.

ERRATA.—*In Mr. Davy's Paper in our last Number,* the dimensions of the intercolumniations of St. Martin's and St. George's are, by an error of the press, described as so many *feet in* diameter, instead of—as so many diameters of the adjacent pillars. Substitute, therefore, in p. 10, Vol I. line 2, 3, 5, for "two and a half feet diameter," *two diameters and a half*—for "two and a quarter," *two diameters and a quarter*—for "three feet diameter," *three diameters.* A comparison of the text with the scale of feet given in p. 9, must have made these errors immediately obvious to the reader. The figures 1 and 2, in p. 10, should exchange numbers; fig. 2 representing the base of St. Martin's columns, and fig. 1 the base of those of St. George's.

Views of the New Entrance to Hyde Park, and of the New Bridge over the Serpentine River, are in the hands of the Engraver; also drawings to scale of the admirably contrived Kitchens of the Royal Pavilion, Brighton.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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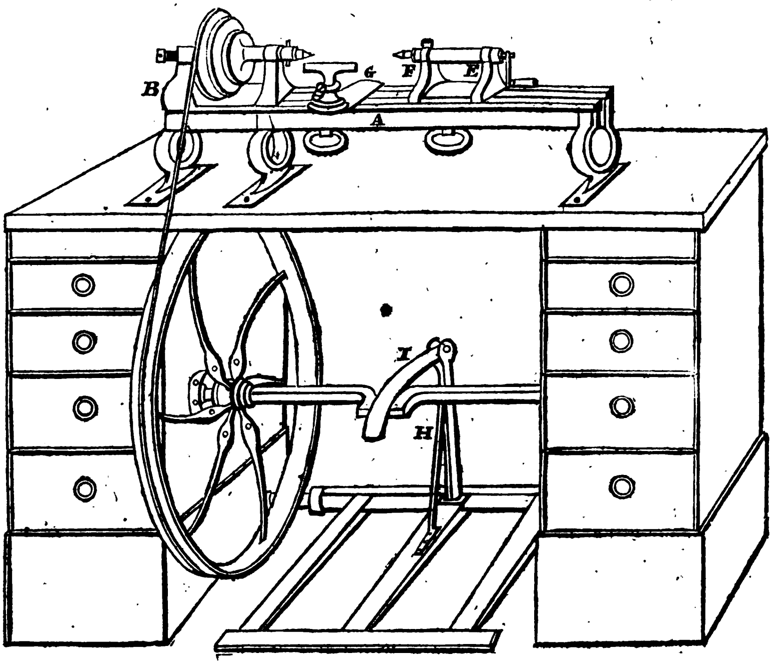
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 206.] SATURDAY, AUGUST 4, 1827. [Price 3*d*.

AMERICAN TURNING LATHE.



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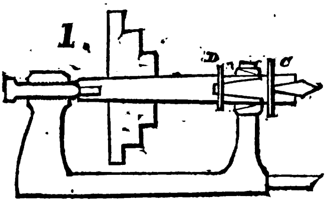

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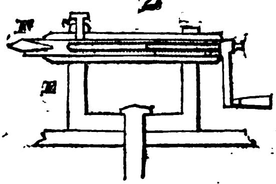

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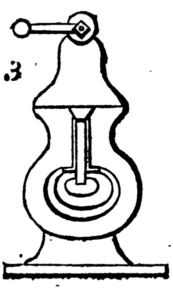

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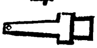

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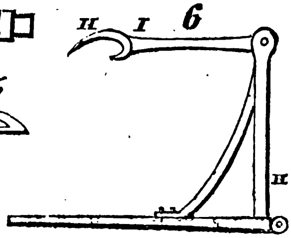


AMERICAN TURNING LATHE.

At the Second Annual Exhibition of the Franklin Institute, a turning lathe made by Mr. Rufus Tyler excited much attention, on account of the perfection of the workmanship, and the improvements in its construction. The sliding parts traversed with an equability and ease which seemed to leave nothing to be desired. The front centre, as may be seen from the prefixed engravings, was a sliding bolt, which might be used without the tightening screw in turning steel or other metals; and the cast steel screw, by which this centre was moved, might be worked its whole length without the slightest shake, *wabble*, or inequality. The centring appeared to be absolutely perfect. In constructing this lathe, Mr. Tyler particularly consulted simplicity; his main object being to produce a lathe adapted to general use. It is represented, therefore, without those appendages which are designed for particular purposes only; such as guides for cutting screws, and eccentric and oval chucks; these, however, may of course be attached to it when desired.

For the following accurate description of this lathe we are indebted to Dr. Jones, the editor of the American Mechanics' Magazine:—

"A represents the shears, of cast iron, with three feet, which serve to connect them firmly at a proper distance from each other, leaving the spaces between them unobstructed by cross bolts, and permitting the sliding head and rest to be taken out without detaching their holdfasts.

"B, the standing head, cast in the usual way.

"E, the sliding head.

"F, the front centre sliding bolt. This is a cylinder, sliding in a hollow cylinder, which is formed in the top of the sliding head. It is moved backwards and forwards by means of a left-handed screw which passes into it.

"G, the rest, cast with a groove underneath, to receive the head of its holdfast.

"Fig. 1.—A section of the standing head, with its mandril and drill chuck. The drill chuck C is slightly conical, and is made fast in the mandril by the key D.

"The drill chuck has a conical hole, which in the figure is represented as containing a steel point. When drills are fitted into this hole, they are sufficiently firm for ordinary drilling, whilst they will generally turn round, from catching or other extraordinary resistance, and thus be preserved from breaking.

"The mandril runs in a conical steel collar, which may be seen in the section.

"The conical end of the back centre is truncated; it works against a hardened die let into the mandril for that purpose, and sustains the pressure in drilling, &c.; preventing that great increase of friction which is produced when the ordinary sharp-angled cone is employed.

"The conical end of the back centre is made somewhat more acute than the opening in the mandril, which lessens the friction, and gives free admission to oil.

"Fig. 2.—E, a section of the sliding head. The front centre is represented as inserted into the bolt at F. At the opposite end is seen the left-handed screw, which is attached by a collar to the hollow cylinder of the head, with which it forms a case, which secures the bolt and screw from chips and dust.

"Fig. 3.—An end view of the shears and foot, with the sliding head and its holdfast.

"The inner edges of the shears are bevelled, and the sliding head has an angular piece screwed upon the bottom, which is nicely fitted into the bevel of the shears. Should any wearing take place, this is compensated by a thin piece of metal inserted between this bevel piece and the head.

"Fig. 4.—A screw chuck, to be substituted for the drill chuck in fig. 1.

"Fig. 5.—A section of the bed of the rest, showing the manner in which the groove is formed.

"Fig. 6.—An end view of the treadle, with its upright shaft H braced, and the pitman I attached to it.

"The form given to the pitman at K, where it fits on to the crank, admits of its disengaging itself when the treadle is obstructed, whilst it is securely retained in its place under ordinary circumstances.

"A crank, with a short pitman, turns one of its dead points much more quickly than the other. In the arrangement of the crank in this lathe, advantage is taken of that peculiarity; the slower turn takes place at the bottom of the tread, and the too quick return upon the

foot, which occurs in the common mode, is consequently obviated.

"The lathe is most conveniently fixed in the way represented in the plate; that is, screwed to a table, which is supported at each end by a case with drawers, leaving a space between for the wheel and treadle.

"The wheel is of cast iron, with the arms curved, to prevent their breaking from contraction at the time of casting. The holes in the arms are to admit of screws to affix a smaller wheel, when a slow motion is required.

"In the old mode of fixing the treadles of lathes, the lever was of the third kind, and the crank was consequently made long. In the modern mode, the lever is of the second kind, and the crank must be proportionably short, or the rise for the foot will be too great.

"This lathe is equally suitable to the use of the professed turner and the amateur, as it is handsome, strong, easily adapted to various purposes, and not liable to get out of order."

VALLANCE'S NEW MODE OF CONVEYANCE.

Sir,—I am sorry to observe that your correspondent "S.Y. a Young Engineer," continues to adopt that supercilious and assuming tone which heretofore drew on him a severe but deserved reproof from "T. Y. an Old Engineer."* He has, in No. 201, thought proper to represent Mr. Vallance as a "visionary," a "pretender to merit," and the projector of "an imposture"—as being either ignorant of the mechanical laws upon which his new mode of conveyance depends, or knave enough to prosecute the enterprise, "*knowing* that success must be altogether hopeless." He affects to feel indignation forsooth, on account of the patronage bestowed on this new scheme; and with the air of a master he puts forth his dictum, "That it is in *every* respect inferior to an *ordinary* railway;" nay, he can demonstrate, if you choose, "that it will require greater power, and consequently greater expense, than will be necessary to draw the same carriage with the same velocity on a railway." It will be in the recollection of your readers, that S. Y. has already favoured them with a demonstration relative to rail-roads, by which he would fain have proved, in opposition to our most scientific characters, that they do not offer those advantages in reference to velocity and power which had been represented. Herein he had the infelicity to demonstrate more than he intended, namely, that he knew very little of the subject on which he presumed to dogmatize. He would do well to profit by what Pope says, which, though not generally applicable, is too true in the case of the superficial and conceited—

> "A little learning is a dangerous thing,
> Drink deep, or taste not the Pierian spring;
> Those shallow draughts intoxicate the brain,
> But drinking largely sobers us again."

The reasoning of some of your correspondents proceeds on the supposition that Mr. Vallance's scheme proposes merely a more economical mode of conveyance than any at present adopted. This is, I conceive, an inferior consideration. The principal question is, whether, at a moderate rate, it be desirable to have communication between the extreme parts of the empire, with such rapidity as Mr. Vallance proposes, viz. 100 miles an hour. If it be, his plan offers the only means of accomplishing it, and ought to have a trial. The demonstration which S. Y. volunteers is quite superfluous; for it will be conceded to him, that, theoretically speaking, less power would be required to produce the same effect on a railway than in Mr. Vallance's tunnel: but this observation is quite beside the question, until it can be proved that such velocity as is here proposed is practicable on that or any other sort of road. Not a tenth part of it has yet been attained, nor is it probable that it ever will, unless the ways are constructed with much greater solidity than they have hitherto been. As to a locomotive

* A valuable correspondent, who, I notice with regret, has not lately enriched your pages with his communications.

carriage moving at the rate of 100 miles an hour, it may without hesitation be affirmed, notwithstanding the YOUNG ENGINEER "cannot perceive any thing to prevent it," that it is utterly impossible. Let him calculate, and he will find that it will take more than a 300 horse power engine, merely to overcome the resistance of *still* air, though there should be presented to it a very moderate area of opposing surface. Where would he take the abutment for re-action?—anywhere beyond the centre of pressure? Is he aware that he would have to encounter a continual hurricane, and such as would demolish to atoms any ordinarily constructed coach or caravan? By the new mode of conveyance, there would on the contrary be always a calm, however rapid the motion. He would probably propose to avoid some of the difficulties, by substituting stationary for locomotive engines; but though a *young* engineer, he would be a very clever one, if he could bring such an immense force, acting with so great a velocity, to bear upon his object at the distance perhaps of several miles. Admitting, however, that the unquestionable talents of our young tyro are equal to this trifling difficulty, yet would the hurricane laugh him to scorn. Besides, has he counted the cost of such sort of machinery as would be required? To use his own words respecting the tunnel, "it will be found no trifle." Has he also considered, that at every station it must be repeated, together with engines equal to the full amount of the force required; that, allowing the stations to be five miles apart, these mighty engines of between three and four hundred horses power, after the trouble and expense of getting up their steam, would be brought into action for the space of only three minutes; and that, consequently, on a line of 100 miles, there would have to be provided twenty times the power which could at any one time be required? When he has duly considered these points, he will discover that the inference which he has drawn from the employment of greater power—of its being attended with greater expense, is a *non sequitur*. An engineer knows, or ought to know, that a saving of expense does not always follow from a saving of power. When the cost of the first outlay would be very great, it may be more economical to adopt simpler and cheaper means, though attended with a greater current expenditure; and this would be more especially the case, if power should hereafter become cheap,—an event not at all impossible. Now, Mr. Vallance's tunnel will bear comparison, on the score of expense, with any rail-way that could be constructed capable of sustaining a similar load, passing along with equal velocity, and furnished with the machinery necessary for producing the effect. Where *time*, therefore, is valued, Mr. Vallance's scheme offers the cheapest mode of conveyance. But this is idle discussion, since the practicability of any other plan may with confidence be denied.

At a future opportunity, I may probably send you a few observations, with a view to strengthen confidence in the practicability of the new project—to such a degree, at least, as to warrant a trial.

I am, Sir, &c.

B. C.

SEPTENARY SYSTEM OF GENERATING LINES BY SIMPLE CONTINUOUS MOTION.

Sir,—As no account of the septenary system of generating lines by simple continuous motion, has yet appeared in your pages, perhaps I may be allowed a corner to say a few words, not at present upon the whole, but only on the third division of the system.

The third division embraces the principles of the common trammel, and the cyclograph or arcograph; the latter being constructed on the principle of the 21st prop. of the 3rd book of Euclid; and the former being the reverse—that is, in the common trammel two points or poles move along two straight lines; —while, in the arcograph, two right lines move against two points. The

former of these motions I propose calling double positive, and the latter double negative rectilinear motions. In other divisions of the system it is, if possible, of still more importance rightly to distinguish the difference between a point moving along a right line, and a right line moving against a point.

In every division of the septenary system, the principles which regulate the motions, must, for the cause and various effects to be clearly understood, be supposed to connect a plane in motion with a plane at rest, and that a pencil, or describing point, may be so fixed as to mark the path of any point on the surface of either plane.

In the division now under notice, the two points or poles must be fixed to one plane, at any distance from each other; and the two right lines formed upon the other plane, either parallel, or crossing each other at any angle. I have subdivided this division into three cases.

First Case.

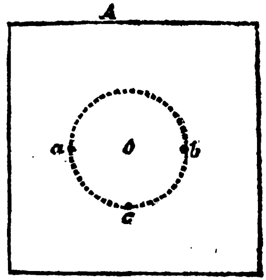
If the right lines are parallel to each other, it is the most simple, and I have, therefore, called it the first case of motion that these principles are susceptible of; and, if the pencil be fixed *to any point on either plane*, its path will be only a right line, and all right lines thus described will be parallel to each other.

If the right lines cross each other, two other cases arise, and various curves will be produced, which it is my object in this paper to explain. Altering either the distance between the poles on the one plane, or the angle of the right lines on the other, will vary the magnitude but not the character of the curves.

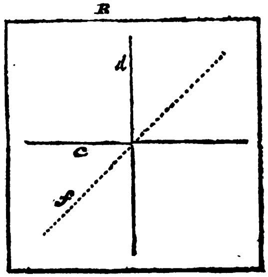
Second Case.

Let A represent one of the planes with the two poles *a* and *b*; and B, the other plane, with the two right lines *c* and *d*, at right angles to each other. Now, if the plane A be supposed to be laid upon the plane B, and if the pole *a* be moved along the line *c*, while the pole *b* is moved along the line *d* (which is the action of the common trammel),

A



B



then, if the pencil be fixed at *o* on the plane A, in the centre between *a* and *b*, its path will be a circle; and, if it be fixed to any point, as *e* on the dotted circle, or *line of the cusps*, on the plane A, its path will be a *right line, as the dotted line f*, crossing *c* and *d* at their point of crossing. The right line thus drawn will be of the same length as the space passed over by either of the poles *a* or *b* along the lines *c* and *d*; or, in other words, every point of the line of the cusps of this case, in this division, describes a right line, while the plane A is turned round on the poles *a* and *b*, along the lines *c* and *d*, and all the right lines thus drawn cross in one common point, and are of the same length, their positions being varied to every possible angle with the lines *c* and *d*: and if a number of right lines were thus described, they would produce a radiated circle. The centre of the line of the cusps, is the point *o* which describes the circle; and the radius of the line of the cusps, is half the distance between the poles *a* and *b*,

when the directing right lines are at right angles to each other. Between any point on the line of the cusps and the centre *o*, the pencil may be fixed to describe every variety of the ellipse, from the right line to the circle. If the pencil be fixed beyond the line of the cusps, it will again produce the ellipse; and, in every direction, at the same distance from the centre *o*, whether within or beyond the line of the cusps, the same ellipse, but each variation of the pencil will vary the position of the line described. The further the pencil is removed beyond the line of the cusps, the nearer the ellipse drawn will approach the circle; but, if the plane were continually extended, and the pencil continually removed to a greater distance, the circle could never be attained.

In this case, the law or order of variation of the lines produced by the motion of the plane A, beginning with and proceeding in every direction from the centre *o*, is thus:—

First.—A finite circle.

Second.—The first series of ellipses.

Third.—The right line.

Fourth.—The second series of ellipses.

Fifth.—Approximating to an infinite circle.

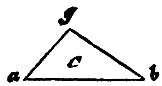
The diameter of the first, or finite circle described, is equal to the distance between the poles when the regulating right lines are at right angles to each other.

In the first series of ellipses, the sum of the diameters of any ellipse is equal to the right line.

The right lines are equal to twice the diameter of the circle; and,

In the second series of ellipses, the difference between the diameters of any ellipse, is equal to one of the right lines.

When the two poles *a* and *b* are at the extremes of the diameter of the lines of the cusps, the regulating right lines *c* and *d* are at right angles to each other. As the line of the cusps is a circle, if *a b* be the extremes of the hypothenuse of a right-angled triangle C, the angle *g*, whether the two legs be equal or unequal, will, if *a* and *b* be moved along *c* and *d* at right angles to each other, describe a right line. If the legs of the triangle be equal, the angle *g* will describe the line *f*.



Now, if *e* and *f* be made the directing right lines, the legs of the right-angled triangle being equal, *a* and *g* may be the two poles; then the angle *b* will describe the right line *d*, and the centre or middle of the hypothenuse will describe a circle—that is, the three angles of every right-angled triangle may be moved along, or describe, at the same time, three right lines, while the centre of the hypothenuse, in every case, will describe a circle. In all cases make the angle of the two regulating right lines the same as the angle opposite the side of the right-angled triangle, the length of which is to be the distance between the poles; the hypothenuse being either half the sum, or half the difference of the diameters of the ellipse to be described. By making the angles formed by the crossing of the regulating right lines more or less acute, the distances between the poles may be made in any proportion less; that is, the trammel-rod may be made in any proportion shorter between the poles than what is requisite when the directing lines are at right angles; and this may be frequently convenient in bridge-building, &c. where large ellipses are required. Any portion of the most extended ellipse may thus be produced in any space a little larger than half the *minor* diameter.

In every other form of triangle, each of the angles may be moved along right lines; but no point within an obtuse-angled triangle will describe the circle; in an acute-angled triangle, that point within it which is the centre of the circle that would pass through the three

angular points, is the point that would describe the circle. Again, every angle of any other figure, from a triangle to one of any greater number of equal or unequal sides, whose angles are all in the circumference of a circle, may each, at the same time, be moved along or made to describe right lines; and any two angles being properly directed, the whole will be regulated.

It may be observed, that the pencil may be adjusted upon the plane A, by equal or gradual variations between any two assumed points, and either in straight or curved lines, or according to any device; and the position of the several points being marked on the plane, a register is formed for the re-production of any series of lines. The shaded effects produced by the paths of a number of selected points crossing each other, is frequently very curious and beautiful.

I have not been able to ascertain when the principle of the common trammel was first discovered, but I should suppose it to be very ancient: neither am I aware that any complete description of the effects of its motion has been hitherto published. Some descriptions that have been given are erroneous, calling the two poles the focii of the ellipse; and all that I have seen, require the regulating lines to be at right angles to each other, and confine the motion to the regulating of a rod only a right line; when compared with the motion of a surface, how limited is the idea?

There are other diversions in the septenary system which will produce the ellipse; but, on this principle alone, a great variety of instruments may be constructed, each of which will have peculiar advantages for particular applications.

I have now, I hope, fully described the first and second cases of the third division; and, as this paper has become longer than I anticipated, I must leave the explanation of the other case to a future opportunity. In conclusion, I will however just state, that the pencil is then fixed to the plane B, and that by that means spiral lines may be drawn with a continued variation of curvature applicable to the Ionic volutes, &c. &c.

I am, dear Sir,
Your's, &c. &c.
JOSEPH JOPLING.

24, *Somerset-street,*
Portman-square.

HINTS ON THE EFFECTS OF SALT ON THE HUMAN FRAME.

(*Continued from p.* 7.)

Mr. Editor,—The excess of oxygen generated by salt, &c. &c. is manifest in all patients afflicted with scorbutic complaints. Such unfortunate individuals are generally fond of butter, and fat meat, and high-seasoned food of every description. The strong hold which the malady has taken of their constitutions seems to increase the propensity for fat, salt, &c. It is truly loathsome to behold some faces disfigured with disease, as if they had been scalded. These having chiefly been forced with mercury, and their patience exhausted, despair of a perfect cure, and continue that sort of regimen that nourishes the evil. But could they be convinced, a contrary course of living, with little medicine, would yet restore most of these I have seen thus afflicted.

Weak-minded people are always slaves to temptation and excitement of every description. Brute animals will be led out of nature's path sometimes: a horse, for instance, may be made to drink fermented or spirituous liquors. A lamb had been so long habituated to animal food on board a ship, that when it came a-shore it was with difficulty it could be made to resume its natural food.

Cattle reared far inland, or in the interior of a large continent, are generally fond of salt; and in America they will lick it off a plate, in the crude state. But were the land at such distances from the sea manured with salt, the grass would be more nutritive, and there would be no occasion for giving salt to the cattle.

The buffalo and deer on the continent of America travel a great distance twice a-year to taste the salt

water. Instinct seems here to guide these animals to seek a bracing change of regimen. The tame animals under the control of man require similar changes, or their provender improved by judicious cultivation.

But the human species are inexcusable in following, as a constant habit, that which nature only designed as a happy change occasionally. Were we to study the nature of our real wants, as we do other things of less importance, our lives might be rendered happy, and of longer duration than is our common lot, according to the existing state of intelligence amongst us. Therefore, it behoves us to train the rising generation to rational habits, to prevent their wanting or desiring things that are not meet for them.

Salt stiffens the skin and flesh, stops the pores, and prevents perspiration.

I could furnish a list of most respectable people, who have been restored to good health by relinquishing the use of salt, &c. &c., who had been afflicted with rheumatisms, &c. &c. for many years before, and whose sensations changed like a thermometer.

Your's respectfully,
GLOBOSUM.

N. B. The importance of the temperance which I advocate is greater than I have words to describe. For intemperance does not consist in intoxicating spirits, wines, and opium, snuff and tobacco, alone: every thing we eat or drink ought to be with judgment as to quantity and quality.

G.

PENCILS.

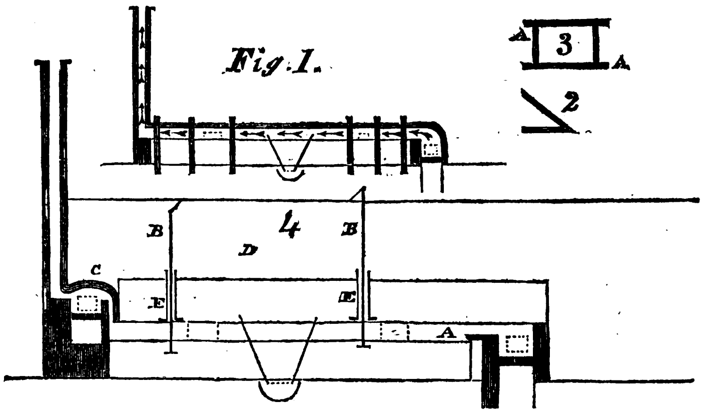
Mr. Editor,—There is one invention wanting in these days, which I think it very singular has not yet been accomplished; namely, a substitute for pen and ink in the field or open air. No doubt hundreds of your readers must have felt the inconvenience of taking dimensions out of doors, as notes in surveying, &c. &c.: the common way, of fixing an ink-bottle to the button-hole of the coat, is in many respects troublesome, and the pen dirty. The blacklead pencil is untrustworthy; the chance of its coming off is also more to be apprehended as the pencil is good; it also requires that the figures should be written so large, that it is very rarely used to advantage. The best thing of the kind I have yet seen is a red pencil I procured in France; but I cannot tell what the composition is. Perhaps it is red lead, or red chalk and bees' wax. It keeps its place—is fixed or indelible; so much so, that India rubber has no effect on it whatever, or any thing else I can yet find: it marks best when slightly damped with the tongue; but it seems to be harder in some parts than others, and writes best on a soft or smooth coarse paper, or even on hard paper, if a piece of blotting-paper is under it.

I wish that this may attract the notice of some of your ingenious chemical readers, and that some one may be successful in producing an article of the pencil kind to supersede the inkhorn in the field: this will oblige the public at large, particularly mathematicians and mechanics; and, I trust, will fully reward the inventor for his pains. The demand for it would doubtless be great and constant.

The French have also a species of white horny substance, which is inserted in cedar, as our blacklead is, to write on a slate instead of slate-pencil; it writes soft, white, and has a much neater appearance than the common slate-pencil used in England.

These trifles, Mr. Editor, I look on as very great conveniences; in commerce they would not be found trifles. The metallic flat-edged pencils, to write on velvet paper, have not been found to answer the expectations first formed of them.

I am, Sir,
Your constant Reader,
BOLNHURST.



IMPROVED PROCESS OF EVAPORATING SALINE SOLUTIONS.

BY MR. JAMES WRIGHT, NEWCASTLE.

Sir,—Your correspondent Micros, No. 193, page 280, says he is deterred from putting the process of surface evaporation, mentioned by Dr. Ure in his "Chemical Dictionary," in practice, by his anticipating certain difficulties which he thinks did not occur to the Doctor when he wrote his account of it. I entertain an opinion, in which I am by no means singular, that my friend Dr. Ure has (with a tact almost peculiar to himself) combined in his dictionary a greater mass of useful practical instruction, with accurate transparent theoretical information, than is to be found in any other work on the subject of even four or five times its size; but it must be obvious, that had he entered into the minutiæ of every manufacturing operation, he would have swelled his work beyond any reasonable limit, and made the price a bar to its being purchased by that class of readers, for whose instruction I know the Doctor particularly intended it. It would have rendered less necessary your useful publication; would have prevented Micros from showing the world the very handsome manner in which he can ask a question, and deprived me of the pleasure of answering him. I have had such vessels as Micros refers to in constant operation during the last thirty years, evaporating the saline solution known by the name of Soap-makers' spent ley. In the soap-manufactory here, which I have superintended nearly twenty years, there are six of them in constant use. The fires have never yet been withdrawn, except for the purpose of repairs; they are made of plate iron, joined together in the same manner that steam-engine boilers are formed; the plates are from 1-8th to 3-16ths of an inch in thickness; the vessels from 8 to 12 feet wide, from 20 to 40 feet long, and from 2 to 2½ feet deep: they may be, and ours are, made of different sizes, to suit, or rather to occupy, the whole of the building in which they are placed, and by placing two in a reverse position, the same chimney is made to serve both; they are set on the floor along the wall of the house, in which wall, at the end of the vessel opposite the fire-place, the chimney is inserted: the fire-place, or rather ash-pit (as may be seen by the prefixed sketch, fig. 1), is sunk below the level of the floor, which admits of the vessel itself being placed upon the floor under the operator's hand; were it raised higher, he would require a stage or platform to stand upon. A 5 inch wall of brick is built along the side of the vessel, to the level of its edge; along the top of this wall is laid a thin plate of cast iron (fig. 2 is an end view of it) to serve as an abutment to the 5 inch

arch of fire-bricks, which is thrown from side to side—except that portion of it which is over the fire-place, and that is thrown from the end wall to the end of the arch, which is kept as low as is consistent with its stability—having not more than from a foot to 18 inch spring at the end next the fire, and lessening gradually to the other end (in order to give the flame and heated air a direction downwards upon the surface of the liquor) to a spring of 6 or even 4 inches at the chimney end. At about each 8 feet in length of the vessel is inserted, as a part of the arch, a cast iron frame and door, of about 2 feet square, as manholes. The under side of this frame rests, by means of its snogs tusks, on the projecting portion A, fig. 3, against the metal abutment, which is here broken off, so that there is nothing here above the edge of this vessel, but the under side of the frame. The door is hinged to the upper side, so that when opened it is quite out of the workman's way. Within about a foot of each man-hole, a 2½ inch square bar of iron is set upright, one end fixed firmly in the ground, and the other or upper end braced by a 1½ inch bar through the wall; this holds the abutment in its place, and without it the arch would not stand. Between every two of these man-holes a small cistern is sunk in the ground, upon which is placed a wooden or plate-iron box of a hopper-shape, with a moveable bottom perforated with small holes. The only utensils necessary for withdrawing the salt, are a long rake and a large shovel, such as in this part of the country is called a ballast shovel, with sides to it, a bottom perforated with small holes, and a 10 or 12 feet stout wooden handle. When the vessel is filled with a saline solution, and a good fire kept up, the aqueous vapour is carried up the chimney: the salt first forms upon the surface, then falls to the bottom, and is withdrawn once or twice a-day. This is done with the perforated shovel: the man (standing on the outside) having first raked the salt near the man-hole, runs the shovel along the bottom of the vessel; then using the handle as a lever and the edge of the man-hole as a fulcrum, lifts a shovelful out of the liquid, allows the superfluous liquor to run off or drain through the salt for a moment, then throws it off the shovel into the wooden or iron hopper-shaped vessel, where in an hour or two it is completely drained of all moisture. From thence, by the shovel and barrow, it is transferred to the storing warehouse; the bottom of the draining-vessel is removed, and the drainings returned into the evaporation.

It must, I apprehend, appear self-evident to your correspondent, that as the flame and heated air must pass in nearly a direct line over the top of the vessel, its being constantly kept near full is essential to the complete success of the operation.

The advantages obtained by this process, over that of applying caloric to the bottom or outside of the vessel containing the saline solution, are these: First, the evaporation is more than doubled in the same time; Secondly, less than half the fuel is necessary for driving off the same quantity of water; Thirdly, there is no labour required for preventing the salt adhering to the bottom of the vessel; Fourthly, there is no loss sustained by the breaking of vessels. And, in the last place, the aqueous particles in the form of steam being carried up the chimney, the work-people are freed from their annoyance: neither is the roof of the house rendered useless in a twelve-month by having them constantly impinging against it. One disadvantage exists where the salt is wanted of a pure colour—it being by this process tinged a little by the soot.

Such was the form of the vessels, and the manner in which the process was conducted, until about a dozen years ago, when we began to make some improvements in their construction: part of these were forced upon me by that mind-stirring principle, necessity; and I am not aware that they are known to or have

been put in practice by any one else. The salts in soap-makers' spent ley, as will be well known by many of your readers, consist principally of the sulphates and muriates of soda and pot-ash. When recovered from the solution, they are mixed intimately with chips of wood, saw-dust, or small coal, and exposed to a strong heat, or, as we technically term it, fluxed, in a reverberatory furnace; by which process the sulphuric salts are decomposed, what is called black ash (a liver-coloured substance containing the soda in a free state) is left in the furnace, and immense volumes of sulphuretted hydrogen gas (the same which burns with a blue colour at the bottom of our gas lights, and occasions the intolerable smell of unburnt gas) are driven up the chimney. This is offensive to persons living in the vicinity, and of course the operation is generally performed out of large towns: now, in the mode of evaporating which I have attempted to describe, it will be found that the salt which forms on the surface does not sink so immediately as could be wished; it will, if the liquor be of a high specific gravity, even extend itself as a crust over the whole surface, causing a partial check to the process; and, in our case, the flame began to act upon the salt, assisted by the soot as a carbonacious matter, causing a partial decomposition of the sulphuric salts, and, as far as it went, throwing sulphuretted hydrogen into the atmosphere. Something like a complaint of a smell arising from this cause was made by the more fastidious portion of the neighbourhood; and as it is the sincere wish of my employers to avoid giving any cause of offence, it became my duty to try some method of getting rid of this inconvenience.

As I was well aware that the salt by itself might be acted upon by heat to any extent without suffering decomposition, I concluded that the soot was the agent in this case; and I was indebted to my friends, Messrs. Parks, of Warwick, for suggesting the means of getting rid of it. This is managed by making the bridge (as we call it) or wall between the vessel and the fire-place hollow throughout, and allowing a thin stream of air to enter all along the breadth of the vessel. (See A, fig. 4). This, however, did not altogether prevent the salt from being acted upon — or else those persons who had begun complaining were unwilling to leave it off; and as I was led to believe I had failed in completely removing the soot from the salt, I determined on abducting the salt from the soot, in which we most completely succeeded. By means of the plungers B B, fig. 4, the tops of which (pieces of chain) are attached to rods connected with a small steam-engine, or any other power, their alternate motions up and down, in and out of the liquid, keep its surface in perpetual agitation, and thus prevent the formation of any salt on the surface. The absence of crust, and the liquor being made to meet the current of flame and heated air in the form (if I may be allowed the term) of waves, the evaporation is prodigiously increased. Being overjoyed at the success of this plan, and wishing to "make assurance doubly sure," we erected the fire-place C at the foot of the chimney, over which fire all the vapour, soot, and gas (if any are found), must pass and be consumed. So completely have these two methods succeeded, that I have not heard of a single observation being made about our manufactory for a very long time.

The last improvement must be of considerable utility where fuel is expensive. It consists in covering the evaporating vessel with a vessel (instead of an arch) similar to itself, but of greater length and breadth (see fig. 4), so as to cover the fire-place, and rest upon the side walls; which, in this case, must be built so high as to admit of a man-hole of about a foot between the edge of the under and the bottom of the upper vessel. The bottom of the under one is made quite flat, while that of the upper one is raised in the middle like a steam-engine boiler; and rods in a similar manner are put through it to strengthen or keep

it together. The plungers are admitted through the upper vessel by means of tubes E E, fig. 4, made water-tight by means of flanges to its bottom. In this vessel the first portions of water are driven off; but the liquid is not allowed to salt them, but runs into the under vessel by means of plug-holes made in any convenient part of the bottom.

I am, Sir,
Your most obedient Servant,
JAMES WRIGHT.

Newcastle, June 11, 1827.

ALE BREWING.

St. Leonard's, Colchester, July 18, 1827.

Sir,—In your entertaining and useful Magazine, page 331, Vol. VII. your correspondent A. Z., Purton, Wilts, is desirous of information how to fine his ale—without *which qualification*, in my opinion, the best ale is comparatively of but little worth. In order that he may have a fine and sparkling glass, I will with pleasure give you the method in which, I am happy to say, I have succeeded every time I have tried it, for at least two years.

Observing the method prescribed by "Experimentum Crucis" (p. 301, Vol. VI.), and having been my own brewer nearly thirty years, I considered his a tedious one; I therefore adopted the following plan:—I brew on a Wednesday from 90 to 100 gallons, and, if possible, get the worts cooled down to 70 degrees by the thermometer that night (after being all put into the mash-tub for a gyle tun, as I make but one sort of ale), and then put in a quart of yeast, having been previously set to work with two gallons of the first wort. By the morning, a fine head is raised, which about noon I skim off, and give the wort a good stir up with the mash-staff; then let the yeast rise again, which, at nine o'clock the next morning, I again skim off; then, having mixed three handfuls of salt and four of flour in a bowl, I strew the whole upon the top of the wort, and give it another good stirring, which produces great fermentation. At night I skim again; and if in the morning more yeast is thrown up, which will generally be the case, I take it off after breakfast, and then put the ale into casks.

From cleansing the ale so much in the tub, much trouble is saved by its fermenting after being tunned; yet sometimes this will occur more or less, which I take off with a spoon (mine being upright casks), keeping them full.

When it has totally ceased working, I put into each cask three or four handfuls of the hops, after being boiled in the worts, which I reserve for that purpose; when quite still from working, I bung them.

By this method, I have invariably had a bright and fine ale, which very much resembles brandy and water in colour, and is quite as clear.

If any of your correspondents should be desirous of having any further information as to my method of brewing, ingredients, &c., I shall be happy to give it.

I am, Sir,
Your most humble Servant,
T. T.

P. S. Whether my ale is fined by the combination of the flour, salt, and hops, I am unable to say; possibly *the hops alone*, carrying down the sediment in the casks, may produce it; but as my beer gives my family such complete satisfaction, I mean to pursue my present method.

I *boil* my first wort one hour, paying no regard to the sinking of the hops, or being able to see your face upon its surface, both of which tests are fallacious; a gentle boiling for an hour produces the desired effect.

I do not use a saccharometer: but have often wished and requested "Experimentum Crucis" to give the public an account of the one he uses.

Sir,—In reply to A. Z.'s queries respecting Brewing in your Number for May last, I beg to say, that the saccharometer, not hydrometer, is the instrument used by

brewers for ascertaining the relative values of different worts—hydrometers being used by distillers for ascertaining the strength of spirits. The saccharometer which I always have preferred is that invented by Dicas; but as your correspondent wishes for a cheap one, I think the one he alludes to will fully answer every purpose he may require.

On the subject of boiling, he seems to labour under an impression that *all* the gluten *unavoidably* extracted from a grist of malt is capable of being deposited by boiling. Boiling must be regulated by the extracting heats used in the mash-tun, and the quality of drink to be made; long boiling is not only very unnecessary, but very injurious to the after-process of drink, especially in the fermenting part. Richardson, in his Treatise on Brewing, recommends boiling down by the saccharometer; that is, to boil your worts down until they come to a certain strength; this I certainly condemn: as to the idea of boiling until the hops sink, hops will sink after one hour's smart boiling. Formerly, brewers boiled their worts until they assumed a flaky appearance; that is, until the gluten seemed floating, and ready to sink in the worts. *That*, though not a bad criterion, is not an over good one; experience alone will instruct a person how long to boil. In general, I boil my worts for porter three hours; for ale, three and a half to four: this depends upon the quality of the malt you are using, and, as I before said, the extracting heats used. I would advise, however, if for ale, that the worts be boiled three hours and a half smartly; if two boilings are made, boil the first one and a half to two hours, and the second from two to three. Your correspondent seems to attribute the cause of his beer being thick to the fault of boiling; but, unless his fermentations are properly conducted, his drink properly filled while cleansing, and his filling-drink properly pitched, it will be impossible for him to have clear drink. I would recommend your correspondent to go to the expense of a good saccharometer, and he can scarcely then be in error.

Trusting you will excuse this intrusion, and assuring you that I shall always feel happy in setting your correspondent A. Z. right, as far as I am able,

I remain, Sir,
Your very obedient Servant,
A Brewer.

Cork, July, 1827.

NAVAL ARCHITECTURE.

Reply of Noah to Philo-Naut.

(*See p.* 234, Vol. VII.)

Sir,—The title of your Magazine ought always to influence those who write for it, strictly to adhere to the plainest words in the English language; and when I see Latin phrases, or words wholly unintelligible to the major part of your subscribers, terminating sentences sometimes of importance, but too generally badly or foolishly applied, I set the writers down as deficient in head or heart. With those impressions I commence this reply to "Philo-Naut." p. 234, Vol. VII.

When *Philo-Naut.* first appeared in the pages of the Mechanics' Magazine, it was easy to discover that he had had but little experience in his pursuits. Considering that a few plain facts would assist in maturing his judgment, I was induced to point out to him that form most expedient for a midship section, together with the station most stable for the ballast; but, from his second production, I am almost tempted to believe that he is no other than an overgrown boy, pleased and amused with sailing small vessels on a pond or river (it must be for those *only* that he contends that the *ballast should be at the keel*), and I should not be surprised (having once introduced "the *leaping*" of vessels) if his next production commences with an account of his pigmy squadron playing at leap-frog. To assist him to the extent of his capacity, and for his amusement, I will forthwith disclose to him the *great secret*.

Take a piece of fir, 2 feet long, 9 inches broad, and 1½ inch thick; shape it like a vessel's deck and side; take a second piece of the same length, ½ inch thick, 5 inches broad for the fore end, and 6½ inches for the after, slope it a little to form a stem and post; beard the ends to a ¼ inch thick; secure the longest edge to the underside of the deck-pieee at the middle line: your transverse section will be nearly of the form of the letter T: take as much lead as will immerse the horizontal piece one half its thickness in the water; divide the lead into two equal parts; fix one half neatly under the lower edge of the perpendicular piece as a keel; divide the other half, and let it in neatly on the upper side at the extreme breadth on deck, taking care that a very small part is the fore side of the half length; divide the deck longitudinally into eight equal parts (if for a cutter), and fix the fore part of the mast at the fore part of the fifth section. Following these directions, you will realize that form, of least resistance and greatest stability, which will outsail every thing of its size.

Having given *Philo-Naut.* the superficial part, *conformable to his own view of the subject*, with which I hope he will be pleased, permit me to deal out a little of the *solids* to those of your readers desirous of information on a plain question in hydrostatics.

I believe that it is not generally understood that an equal weight in wood or iron is of the same specific gravity, as it respects the immersion of the vessel which contains it, although not equal in stability. Suppose a vessel, whose weight, with all her furniture, is 60 tons, and that it requires 60 tons of stone ballast to bring her down to her sailing trim, her deck then being 4 feet above the water's edge; suppose the part above the water to be equal in contents to the part immersed, which is about 4300 square feet; let the 60 tons of ballast be lifted by dunnage, so that 10 tons shall be above her water-line, the upper surface of which is 20 feet broad: suppose that, under a press of canvas, she dips her lee gunwale in the water, which increases her displacement to leeward, say 1000 square feet—above 27 tons; this displacement being effected by a lever in midships, produces a buoyancy equal to that displacement, and (like a bladder kept under water by the hand) pressing in all directions for relief, it would, on flying off to the weather side, lift in the same ratio as she dips to leeward, but for the resistance made by the ballast, which prevents that side from rising only 2 feet, or one half; by this there is 2½ feet of the ballast to windward above water; which being equal to 15 tons, acts at the end of a lever of 10 feet, which added to the 1000 feet of displacement to leeward, increases the opposing power to the wind little short of 50 tons, or about 1800 square feet. That part of the ballast to leeward, by *some considered an evil*, has now lost that tendency, by being under water 3½ feet; and in that station keeps the vessel steady, when its counter-part to windward performs the part of a powerful lever, giving her a stability which double the weight below would not effect.

Take the same vessel; fix 10 tons of iron to her keel, with 50 tons of iron or stone ballast in the lower part of the hold; if under canvas, and with her lee-gunwale in the water, she would not displace more than 800 square feet, because the pressure from the displacement flying off to leeward, and having no ballast above water to counteract the resistance, her side would rise to windward above 3½ feet (*Philo-Naut.* makes it *equal*, see figure under his third head). This would be the fact, but for the weight of the side being so much out of the water counteracting it. Thus you see the vessel, whose ballast is brought up level, or above the line of floatation, has 1800 feet of resisting power against her canvas; when the one, whose ballast is at the keel, or low in the hold, has not more than 1000 feet. It is this that gives that great

stability to our men-of-war—it is this that prevents our row-boats from upsetting, whose ballast is *men*, the centre of gravity being a foot above the water.

I could adduce, if your limits would admit, many proofs to confirm the above; and for this I may have a further opportunity, but at present I shall confine myself to the following:—Haul a vessel alongside a wharf, place 5 tons of ballast to her keel or in the hold, get a tackle from the mast-head) to a bollard on shore—three men with ease will give her what list they please; but take a ton from the hold, and place it on deck on the off-side, eight men will then barely perform the same task: again, let the ton remain on deck, and shift the 4 ton to the opposite side of the keelson, still the ton side will preponderate.

I am, Sir,
Your obedient Servant,
NOAH.

PERPETUAL MOTION.

Sir,—In No. 200, page 393, of your Magazine, a correspondent, signing himself "Richard Else," offers a scheme of a perpetual motion, in which probably he thinks the great desideratum obtained. That it is not so, I think I am able briefly, but satisfactorily, to prove; the insertion, therefore, of the following will much oblige

SOMEBODY ELSE.

A few moments' attention to the principles of R. E's. machine, will shew them to be defective, because requiring that a less impulse should overcome a greater resistance. This statement I proceed to prove.

The resistance opposed by the catch I C (on the right-hand side of the plate) to any impulse, is something more than three pounds; this resistance being occasioned by the force of the spring, equal to three pounds, the weight of the catch and its friction on its fulcrum.

The impulse, R. E. erroneously imagines to be *four* pounds; on the contrary, it is *not quite three* pounds. Supposing the pendulum to fall from the situation represented in the figure, it would rise to an equal height on the opposite side, if all obstacles were removed. But though it starts with a momentum equal to two pounds, yet that is continually diminishing in consequence of friction and the resistance of the air. The end *b* coming in contact with K, something more than one pound is lost, and the pendulum continues its motion until the momentum being destroyed, it is stationary for a moment of time, and then returns. Let the point where it is stationary be called *n*, and let the pendulum again start from the situation in the figure, with the additional momentum of three pounds from the spring. This three pounds is undiminished until the pendulum arrives at *n*; it is then called into action, and gradually diminishes from the obvious causes above stated,—friction and the resistance of the air. Hence the momentum with which the pendulum strikes the catch is something *less* than three pounds, to overcome a resistance something *more* than three pounds.

For the credit of your readers, on the score of common sense, I hope that the above remarks have been anticipated by the generality of them; and I would not have intruded them on your notice, but I am unwilling that error should sully your pages unopposed.

With perfect good-will towards R. E. I have written these remarks; with the same good-will I here present them to his notice; and if they serve to convince him of the invalidity of his scheme, I shall feel myself completely recompensed for the trouble I have taken in writing them.

S. E.

INQUIRY

Respecting Works for Smelting Iron Ore with Peat.

Sir,—Some years ago I saw an account that Works were to be erected in Ireland, for the purpose of smelting iron ore with peat. I shall

feel thankful if any of your numerous correspondents will inform me, through the medium of the Mechanics' Magazine, whether the plan succeeded or not; and if it did, in what part of Ireland the Works are erected. Or, if the proposed plan was not carried into effect, perhaps some one can inform me whether the experiment has ever been tried in any part of the United Kingdom.

I am, Sir,
Your obedient Servant,
Q.

July 20, 1827.

LONDON MECHANICS' INSTITUTION.

No. 10.

"Fideliter."

Lectures.

Friday, July 6.—Mr. Dowling on a New System of Arithmetic.

Wednesday, 11.—Mr. Brayley commenced a Course on the Structure of Invertebrated Animals, showing their Connexion with the Human Race.

Friday, 13.—Mr. Dowling finished his Lectures on Arithmetic, which have not certainly been the best ever delivered. The beginning of the first Discourse was occupied in explaining his system; after which nothing was done but the working of sums on the new plan. The unequivocal signs, which many of those present did not take pains to suppress, must have convinced the worthy gentleman of their opinion as to the merits of his Lectures.

Friday, 20.—Mr. Toplis on the Strength of Building Materials.

Wednesday, 25.—Mr. Brayley on Invertebrated Animals.

Friday, 27.—Mr. Edwin Chapman—an interesting Lecture on the Nature and Object of Eloquence.

Mr. Dufief's French Class having filled rapidly, he is under the necessity of holding his Meetings in the Theatre; so that those Members who wished to join, and were prevented on account of the want of accommodation, will now be admitted.

Fresh arrangements in the Drawing Department have been entered into by the Committee; so that those new Members who may wish to enter can now be accommodated.

MECHANICAL PARADOX.

Sir,—On looking for an article in "Hall's Encyclopedia," my eye happened to glance at the word *Paradox*, which is defined to be "a proposition seemingly absurd, as being contrary to some received opinions, but yet true in fact." Of this the following example is given:—"If the teeth of one wheel should take equally deep into the teeth of three others, it should affect them in such a manner, that, in turning it any way round its axis, it should turn one of them the same way, another the contrary way, and the third no way at all." Now, Mr. Editor, it is very easy to comprehend the feasibility of action in the two first-mentioned wheels; but how a wheel shall work in another without moving it at all, is so truly paradoxical, that I request the favour of some of your able correspondents to explain it, for the information of many a one beside your constant Reader,

INVESTIGATOR.

NOTICES TO CORRESPONDENTS.

We intend to resume the subject of the Patent Laws in our next.

Communications received from A Country Engraver — A Subscriber at Manchester — J. P. — A Constant Reader — J. B.—W. G.—X. Y. Z.—W. Dowling—T. C. E.—Philo—Truth—W. C.—J. R. P.—J. Long—W. D.—Mr. Baddeley—C.—B. J.—A Friend.

Supplement to Vol. VII. price Sixpence, and Vol. VII. complete, in boards, price Eight Shillings, are now ready.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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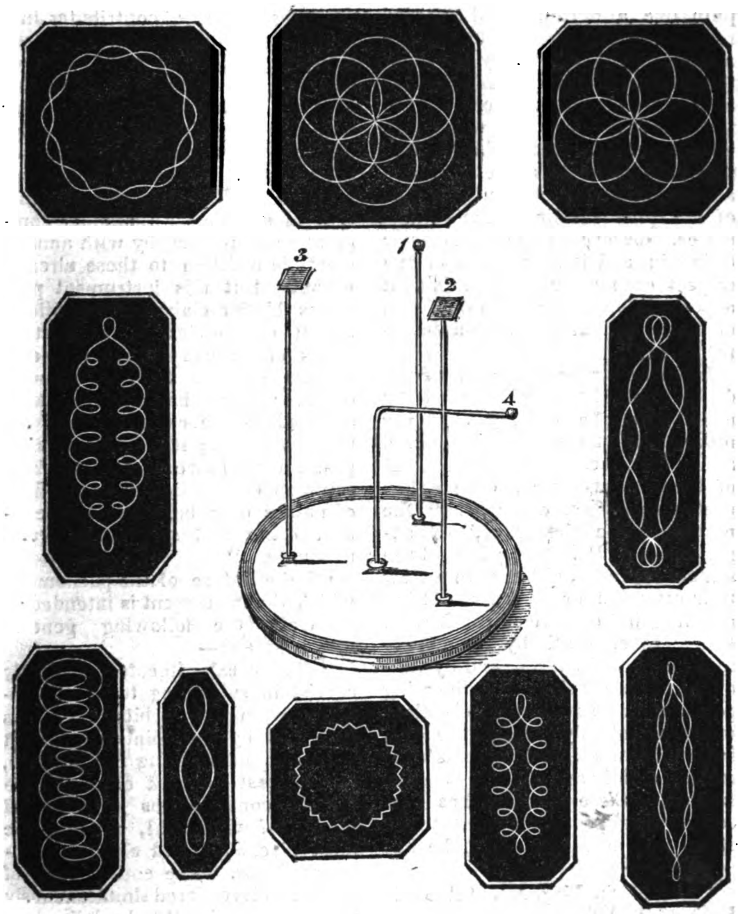
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 207.] SATURDAY, AUGUST 11, 1827. [Price 3d.

> " Unerring Nature! still divinely bright,
> One clear, unchang'd, and universal light,
> Life, force, and beauty, must to all impart,
> At once the source, and end, and test of art."
>
> POPE.

THE KALEIDOPHONE, OR PHONIC KALEIDOSCOPE.



THE KALEIDOPHONE, OR PHONIC KALEIDOSCOPE.

In the "Philosophical Transactions for 1800," Dr. T. Young first brought the following remarkable phenomena into notice:—"Take one of the lowest strings of a square piano-forte, round which a fine silvered wire is wound in a spiral form; contract the light of a window, so that when the eye is placed in a proper position, the image of the light may appear small, bright, and well defined, on each of the convolutions of the wire. Let the chord be now made to vibrate, and the luminous point will delineate its path like a burning coal whirled round, and will present to the eye a line of light, which, by the assistance of a microscope, may be very accurately observed. According to the different ways by which the wire is put in motion, the form of this path is no less diversified and amusing, than the multifarious forms of the quiescent lines of vibrating* plates, discovered by Professor Chladni; and it is, indeed, in one respect even more interesting, as it appears to be more within the reach of mathematical calculation to determine it."

In consequence, however, of the difficulty of distinguishing with the naked eye the quickly changing movements of the vibrating chord, and of the necessarily limited extent of these movements, even when accurately observed with "the assistance of a microscope," the experiments of Dr. Young have been seldom repeated, either with a view to information or pleasure. It has at length occurred to Mr. C. Wheatstone, that, by employing rods instead of chords, and by illuminating intensely the delineating points of these rods, the vibrations might be not only greatly extended, but made, in all their symmetrical variety, clearly and distinctly visible. And both these ideas he has successfully realized in the construction of an instrument, to which he has given the appropriate name of "Kaleidophone" (from καλος, beautiful, and φωνή, sound or vibration).

In the property of "creating beautiful forms," the Kaleidophone resembles the celebrated invention of Dr. Brewster, from which its name is modified; but between the two instruments and their modes of action there is no similarity whatever.

Mr. Wheatstone introduces his account of the instrument (Quarterly Journal of Science, New Series, No. 2) by the following just observations:—

"The application of the principles of science to ornamental and amusing purposes, contributes in a great degree to render them extensively popular; for the exhibition of striking experiments induces the observer to investigate their causes with additional interest, and enables him more permanently to remember their effects. I shall not, therefore, need an apology for presenting the tyro in science with another combination of philosophy with amusement, in addition to those already extant. But this instrument possesses higher claims to attention; for it exemplifies an interesting series of natural phenomena, and renders obvious to the common observer what has hitherto been confined to the calculations of the mathematician; it presents another proof, that however remote from common observation the operations of nature may be, the most beautiful order and symmetry prevail through all."

Of the nature of the phenomena which the instrument is intended to illustrate, the following general idea is given:—

"These experiments principally consist in subjecting to ocular demonstration the orbits of paths described by the points of greatest excursion in vibrating rods, which, in the most frequent cases (those of the combinations of different modes of vibration), assume the most diversified and elegant curvilinear forms. The entire track of each orbit is rendered simultaneously visible, by causing it to be delineated

* See Mech. Mag. Art. "Acoustic Drawing." Vol. VI. page 64.

by a brilliantly luminous point; and the figure being completed in less time than the duration of the visual impression, the whole orbit appears as a continuous line of light: as, besides the changes which result from the combinations of the primitive with the higher modes of vibration, the figures of the orbits are affected by the form of the rod, by the extent of the excursions of the vibrations, by the mode of producing the motions, and by many other circumstances, a great variety of pleasing and regular forms is obtained. This variety is also enhanced by giving the same motions to a number of symmetrically disposed luminous points, the mutual intersections of the orbits of which produce innumerable elegant forms; and the appearances may be still more variegated by occasionally causing these points to reflect differently-coloured lights."

The apparatus for exhibiting these experiments (see the central figure in our front page) consists of a circular board about nine inches in diameter, into which are perpendicularly fixed, at equal distances from the circumference and from each other, three steel rods, each about a foot in length. The first rod is cylindrical, about 1-10th of an inch in diameter, and is surmounted by a spherical bead* which concentrates and reflects the light which falls upon it. The second is a similar rod, upon the upper extremity of which is placed a plate moving on a joint, so that its plane may be rendered either horizontal, oblique, or perpendicular; this plate is adapted to the reception of the objects, which consist of beads differently coloured, and arranged on pieces of black card in symmetrical forms. The third is a four-sided prismatic rod, and a similar plate is attached to its extremity for the reception of the same objects. Another rod is fixed at the centre of the board; this is bent to a right angle, and is furnished with a bead similarly to the first-mentioned rod. A small nut and screw is fixed to the board near the lower end of the first rod, in order, by pressing upon it, to render occasionally its rigidity unequal. A hammer, softened by a leather covering, is employed to strike the rods; and a violin-bow is necessary to produce some varieties of effect.

The different appearances which the rods present when in action, and the modes of producing the different effects, are thus described by Mr. Wheatstone:—

"No. 1. On causing the entire rod to vibrate, so that its lowest sound be produced, as it is seldom that the motions of a cylindrical rod can be confined to a plane, the vibrations will almost always be combined with a circular motion. When the pressure on the fixed end is exerted on two opposite points, and the rod put in motion in the direction of the pressure, the following progression in the changes of form will be distinctly observed: the track will commence as a line, and almost immediately open into an ellipse, the lesser axis of which will gradually extend as the larger axis diminishes, until it becomes a circle; what was before the lesser will then become the larger axis; and thus the motions will alternate, until, from their decreasing magnitudes, they cease to be visible. In the case just described, the ellipses make a right angle with each other; but by altering the direction of the motion, so as to render it oblique to

"* The only beads well adapted for this purpose are made of extremely thin glass silvered on the interior surface, and about one-sixth of an inch in diameter; they are to be obtained at the shops under the name of steel beads. The protuberances at the apertures must be removed or blackened, otherwise the reflections from them will render the images confused. To produce the coloured tracks, these beads must be coated with transparent colours, such as are ordinarily used for painting on glass; the light will then be reflected through the coloured surface; but in beads made of coloured glass, the reflection being made from the external surface, shows only white light. The bead is cemented into a small brass cup screwed to the top of the wire."

the direction of the pressure, they may be made to intersect under any required angle, and when this angle $= 0$ the motion will be merely vibratory.

"Every single sound formed by the subdivisions of the rod will present similar appearances, but the excursions will be smaller as the sound is higher, or, which is the same thing, as the number of the vibrations increases.

"In the most simple case of the co-existence of two sounds, shown by putting the entire rod in motion, and producing also a higher sound by the friction of a bow, the original figure will appear waved or indented; and as unity is to the number of indentations, so will the number of vibrations in the lower sound be to the number in the higher sound. On varying the mode of excitation, by striking the rod in different parts and with different forces, very complicated and beautiful curvilinear forms may be obtained: (some of these are represented by the figures surrounding the instrument in the prefixed engraving).

"Placing the hand on the lower part of the rod, below the place at which it is excited, the excursions of the motions will rapidly decrease and exhibit spiral figures.

"To obtain the figures with brilliancy and distinctness, a single light only should be employed, as that of the sun, a lamp, or a candle; rays of light proceeding from several points, as from a number of candles, or from the reflection of the clouds, occasion the track to be broad and indistinct; but double lights may be employed with effect, provided they be of equal intensity and symmetrically placed; each bead will then describe two similar figures. The appearances, in a bright sunshine, are remarkably vivid and brilliant.

"No. 2. Although very beautiful and varied forms may be produced from the motion of a single point, yet the compound figures which are presented by objects formed by a number of points, offer appearances still more pleasing to the eye.

"An object being placed horizontally on the plate, and the rod being put in motion, the mutual intersections of the points, each describing a similar figure, present to the eye complicated yet symmetrical figures, resembling elegant specimens of engine-turning." (See the second of the figures in our front page).

"When the plate is horizontal, the figures are all in one plane; but if it be inclined or perpendicular, the curves being then made in parallel planes, give the idea of a solid figure, and in some cases the appearances are particularly striking.

"Complementary colours alone should be employed in the objects; for these harmonizing together, give greater pleasure to the eye than an injudicious combination of discordant tints: the intensities should be occasionally varied, and colourless light intermingled with the different shades.

"No. 3. When this prismatic rod is put in motion, in the direction of either of its sides, the points move only rectilineally, but when the motion is applied in an oblique direction, a variety of compound curves is shown.

"No. 4. When a rod is straight, the curve produced by any point describing its motion, is always in the same plane; but in a rod bent to any angle, the two parts moving most frequently in different directions, curves are produced whose parts do not lie in the same plane. A few trials will soon indicate the best way of applying the motion, so as to cause the two parts to vibrate in different directions."

Mr. W. remarks, in conclusion, "that the application of this mode of experimenting may be extended to the delineation of every description of curvilinear and angular motion, when the amplitudes of the tracks are not too great; and that, by this means, it is not improbable that the experimental knowledge of many interesting principles in science may be facilitated."

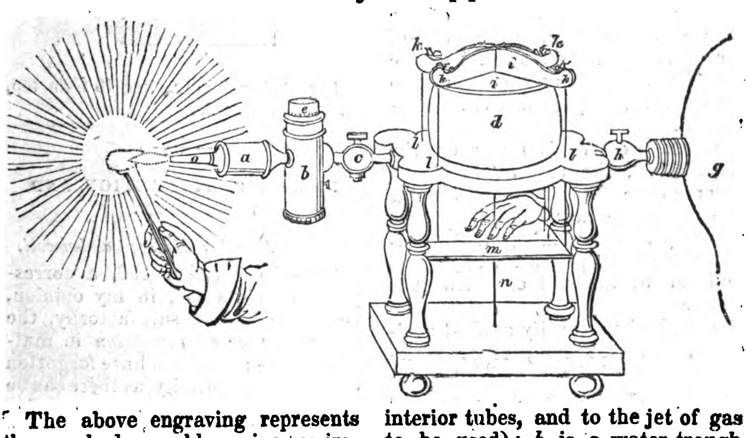
WEEKES'S SAFETY GAS DEFLAGRATOR, AND GURNEY'S OXY-HYDROGEN BLOW-PIPE.

Sir,—Your ingenious correspondent, Mr. Weekes, seems to be unacquainted with the oxy-hydrogen blow-pipe invented by Mr. Gurney, which is described in "Gurney's Lectures on Chemistry." I have one on this principle, which produces the most brilliant effects, and can be used with perfect safety. Platina may be melted by it as readily as wax in the flame of a candle; and a piece of lime submitted to its action emits such a dazzling light that it is impossible to look at it. If an explosion should happen, it could only burst the bladder; and of course no dangerous effects could result from the rupture of such a soft material. The author says he has produced a flame ten inches long. I have never had a jet with an orifice sufficiently large for this; but I do not think any other sort of blow-pipe will give a larger one. These machines are to be procured of Mr. Banks, philosophical instrument maker, Strand; also at Mr. Joyce's, Old Compton-street, Soho. I find a leaden weight much more convenient than the hand to keep up the necessary pressure.

Your's, &c.
T. C. E.

The following description of Mr. Gurney's blow-pipe, which we extract chiefly from "The Chemist," will serve to explain the difference between his safety expedient and that of Mr. Weekes. It must be granted, we think, that though the latter gentleman has not been the first to introduce safety into operations with the blow-pipe, he has devised a contrivance for the purpose, which has the merit, not only of perfect originality, but of superior simplicity. Mr. Gurney interposes layers of wire gauze to prevent the retrocession of the flame, (on the same principle as Sir Humphrey Davy's Safety Lamp); Mr. Weekes makes use of common sponge, and finds it quite as effectual.—EDIT.

Mr. Gurney's Blow-pipe.



The above engraving represents the oxy-hydrogen blow-pipe, as improved by Mr. Gurney: *a* is a safety apparatus, containing a number of layers of wire gauze, which admits a free passage to the gas, but through which flame cannot pass—(it is necessary to make the size of this chamber in proportion to the interior tubes, and to the jet of gas to be used); *b* is a water-trough through which the gas must pass from the gasometer *d* by the stop-cock *c*, and through a tube which reaches to the bottom of the water; *e* is a cork, which takes out, to admit water to be poured into the trough when first used; *g* a trans-

ferring bladder, which screws and unscrews to and from the stop-cock *h*, by which the gasometer is charged by an assistant during its action, and the quantity of gas supplied, so as to keep up a flame for any length of time. Between the gasometer and the charging bladder there is a valve placed to prevent a return of the gas; *i i* a light pasteboard or wood cap, attached to the apparatus by the strings *k k k k*. To these strings are attached small wires, which pass through holes in the table of the instrument *l l l*, and are again affixed to a moveable press-board *m* below; this press-board is regulated and kept in a horizontal position by the perpendicular stand *n*; so that when the necessary weight or pressure is placed on it, it may draw the cap *i* horizontally and equally on the gasometer *d*. The gasometer bladder *d*, or silk bag, is tied to a bladder-piece, which screws into a long tube laid into and across the table of the instrument. This bladder-piece, to which the gasometer is tied, permits it to be unscrewed from the table of the instrument at pleasure, and immersed in warm water to render it soft when occasion requires. To one end of the tube, which is let into the table of the instrument, the stop-cock of the charging bladder is attached, and to the other the stop-cock of the water-trough.

When pressure is made on the press-board, the cap *i i* is drawn down on the gasometer, and the gas it contains is forced through the stop-cock, water-tube, and ultimately through the safety apparatus and jet at the end of which it is burnt.

As a farther security against accidents, Mr. Wilkinson, of Ludgate-hill, suggested the expedient of introducing layers of asbestos between the layers of wire gauze; and in Mr. Gurney's blow-pipe, as now constructed, this improvement is, we believe, generally adopted.

We take this opportunity to correct some Errata which crept into Mr. Weekes's account of his Safety Deflagrator.

In the heading of the Essay, for W. S. &c. read W. *H.* Weekes.

Page 425, column 2, line 20 from top, for *retorts* read *resorts*.

In fig. 1, page 427, the letter *b* is wanting towards the left-hand of the horizontal dotted line.

Fig. 2, for *h*, on right-hand side of the sketch, read *k*.

Fig. 7, for *p*, on the right-hand, read *q*.

Fig. 5, *l* is omitted against the circular flat rim at the foot of the figure.

Page 437, column 2, line 19 from bottom, for *interior* read *anterior*.

Fig. 14, letters *r s* are wanting above and below, at the extreme right-hand side of the figure.

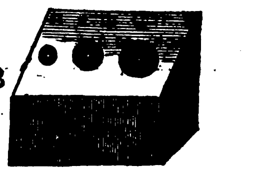
Page 438, column 1, line 40 from top, for *frames* read *flames*.

——— column 2, line 3 from bottom, dele *o*.

Fig. 22, for reference *h* read *k*; *h* is wanting at the extreme upper point of the rod in this figure.

Page 439, column 2, line 15 from top, for *fig.* 3 read *fig.* 23, the engraving of which, having been omitted, is here inserted.

23



Page 441, column 2, line 10 from top, for *wire* read *wires*.

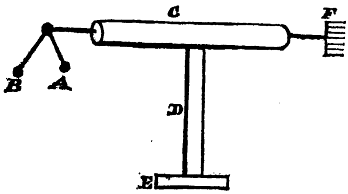
ELECTRIC ATTRACTION AND REPULSION.

Mansion House, Camberwell.

Sir,—In Number 196, a correspondent points out, in my opinion, very forcibly and satisfactorily, the non-existence of *repulsion* in matter; but he appears to have forgotten to look into electricity, as there can be found in that much stronger proof of the non-existence of repulsion than any he mentions. His evidence is only hypothetical; but this is actually practical. Most authors lay it down as a universal law, that where attraction ends, repulsion commences; but this I cannot allow: I maintain there is no such thing as repulsion, either natural or expe-

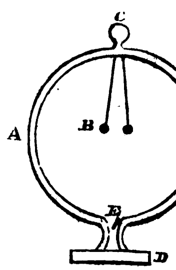
rimental. All is attraction. I shall only at present prove that there is no such thing as electrical repulsion; to establish which, I shall introduce the following experiments:

Let A and B represent two pith



balls suspended by thread to the prime conductor C of an electrical machine, of which D is the glass pillar, E the stand, and F the fork to receive the fluid from the machine. Now, if the machine be put into action, the fluid will pass from the machine through the conductor to the pith balls A B, which will become positively electrified, and will REPEL each other; so, at least, say most authors (indeed, I never read one who did not), owing to their possessing abundance of the fluid. I must now describe another piece of apparatus to prove my argument.

Let A represent the section of a



glass globe, B two pith balls suspended freely in the interior, C a metal cap made to fit air tight, D a stand for supporting the globe A. At the bottom of A is a valve made to open downwards, marked E. To use this apparatus you must take A out of the stand, and screw it on the plate of an air pump, and well exhaust it; after which apply it to the electrified conductor. Now, if the pith balls A B, fig. 1, repelled each other, the pith balls in fig. 2 ought to do the same; but that they will not do, if the globe or electroscope be well exhausted; clearly proving, in my opinion, that there is no such thing as electric repulsion: for if the balls repel each other in the atmosphere, they ought to do so in vacuo. I account for it in this manner. The balls become charged with a superabundance of electricity, and they diverge to give off that superabundance to the surrounding atmosphere; not, as some suppose, repel each other; for if the electric fluid possesses the power of repulsion when surrounded by the atmosphere, it ought to possess the same properties in vacuo. The reason of the balls not diverging, is the want of a conducting medium to carry off the superabundant fluid.

If a glass tube be rubbed with a dry piece of flannel, a feather, when brought near it, will at first be attracted (and as some say repelled) and become charged; when full, it will recede from the tube to the nearest conductor, and deliver up the superabundant fluid;—no repulsion here.

I must now conclude; not that I have exhausted the proofs of the non-existence of repulsion, but that I think I have gone far enough for the present. I therefore take my leave, and am,

Sir,

Your's truly,

R. L——E.

June 11*th*, 1827.

PROCESS BY WHICH ENGRAVERS TAKE THEIR BEAUTIFUL WAX IMPRESSIONS.

Sir,—In answer to a request of a correspondent, (p.416, Vol. VII.) to be informed how engravers take their wax impressions, I beg leave to give the following directions; they may be prolix, but as a good impression depends upon attention to minutiæ, I consider it requisite to be as particular as I can. In the first place clean the engraving with soap and water, then prepare the stone as follows:—Take a little grease (very little is requisite) and rub it

thinly upon the back of the hand; then, with a fine brush (a tooth-brush will do provided the hair is very soft) take it off and brush the stone: there will be sufficient grease upon the stone for the vermillion to adhere to; only be careful not to smear it across, but dab the brush upon it perpendicularly, by which a surface is produced resembling a mezzotinto ground. Many of the engravers pay little attention to this part; but from experience I am well convinced, unless the stone is properly greased, the surface of the impression will never appear to advantage. Now take a camel's-hair pencil, and dip it in Chinese vermillion (which is 1*s.* the ounce); turn the brush upside down, and tap gently upon the table, so that the vermillion may fall into it and not lay upon the top, otherwise it will so clog up the work that all its sharpness will be lost; apply it to the stone, holding it perpendicularly, to preserve a smooth regular surface; when that is done, blow off the superfluous colour, and proceed as follows. Cut a strip of stout paper to put your wax upon, which melt over a candle, holding it about half an inch from the flame, (be careful not to burn or smoke it); keep turning it round, so that the stick of wax may be melted all round; when sufficiently so, put it upon the paper, and so on till there is a sufficient quantity: take the paper and hold it over the candle, and when soft stir it round, and continue doing so till it is the size necessary. Take it from the candle, and continue stirring till the surface is perfectly smooth and free from air bubbles; keep the greatest portion of wax in the middle, so that there may be a good rim round the edge of the engraving: lay it down, and take up the seal (do not be hasty, it will continue hot some time), and hold it over the candle, so that the flame just touches it. When sufficiently hot, (experience will be the best guide in this particular)—nearly as hot as it can be borne upon the back of the hand will, perhaps, be the best guide—apply it to the wax, not hastily but steadily, holding the seal between the finger and thumb by the top: let it stand, pressing gently upon it till the wax is set, which may be told by pressing upon the edge with the nail; when it is so, put your fingers round the impression to keep it down, and pull the seal off. If the impression is good, the engraved parts will be dull; if on the contrary, the work will be shining, in which case the seal has been too cold. If the surface in the plain part is marked and rough, the seal has been too hot. Practice will soon enable you to avoid these defects.

Let the wax, before the seal is applied, be rather stiff than otherwise. The best wax is sold by Mr. Field, at his manufactory, near the Marsh Gate, Lambeth, at 7*s.* per pound; or it may be got at some of the engravers' shops. It is called engravers' wax, being superior to that in general use, and perfectly free from that unpleasant smell the common wax always has.

I have, I believe, stated every particular; but should your correspondent find any difficulty, I shall be happy to give him, through the medium of your Magazine, any further information he may require.

Your's obediently,

J. P.

RECIPE FOR PRESERVING POTATOES.

Sir,—A correspondent in your Magazine having expressed a desire to know the best method of preserving potatoes during a voyage at sea, I willingly communicate the following simple though effectual method, which may not only be useful to him, but to many others in similar circumstances.

Merely dip the potatoes in boiling water for the space of a minute or two; by this means vegetation will be effectually checked, and they may be preserved for many months in a perfectly sound state. The only precaution necessary to be observed is, after the process, to have them perfectly dry before they are stowed.

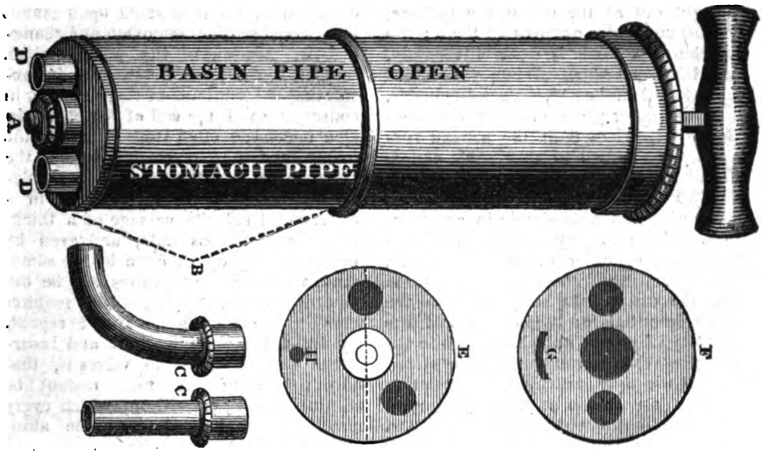
I remain,

Your's, &c.

B. J.

IMPROVED STOMACH PUMP, OR INJECTING SYRINGE.

Invented by Francis Fox, jun. M. D. House Surgeon to the Derbyshire General Infirmary.



We extract, at the request of Dr. Fox, from a late number of the "London Medical and Physical Journal," the following description of an improved Stomach Pump, or Injecting Syringe, invented by that gentleman; to which are added a few additional explanations with which Dr. F. has favoured us.

The instrument is constructed in the following manner:—The piston, with a square rod sliding through a square collar at the lid of the syringe, moves in a common cylinder, as in other syringes. The bottom of the syringe is composed of moderately thick brass, having two holes in it, through which the matter to be pumped passes: this circular brass end is turned on the outside at the end, and has another circular piece of brass, with two similar-sized holes in it; these two holes terminate in two projecting short pipes, to which the stomach-tube and the basin-tube are fixed. The touching surfaces of these two circular pieces of brass are ground together so as to fit air-tight, and to move smoothly on each other. To the lower or outer of these pieces, at its edge, is fixed a cylinder, which will fit on the outside of the barrel of the syringe without touching the same. This outer cylinder extends half way up the barrel of the syringe, and is grasped by the left hand when the instrument is in use, (this may be called the hand-cylinder); the right hand holds the handle of the piston-rod. The holes through the inner piece of brass are on each side the centre, but rather more than one diameter of one of the holes out of the line of the diameter of the brass; the two holes through the outer piece of brass are exactly in the line of its diameter, one on each side of its centre. The ground surface of the outer brass is kept in close contact with that of the inner brass, by a milled nut at the end; and there is a simple stop to prevent these too ground surfaces from revolving too far; so that when the stop acts in one direction, the hole on one side the centre is open, and when the stop acts in the other direction, the opposite hole is open, and so on alternately.

When the syringe is held in the proper position for use, that is, nearly in the horizontal direction, the words STOMACH PIPE and BASIN PIPE are to be seen on the upper surface of the hand-cylinder, and the word OPEN on the barrel of the syringe: thus, grasping the hand-cylinder in the left hand, and the handle of the piston-rod in the right hand, by means of the square piston-rod the barrel of the syringe is turned at pleasure by the right hand, either one way or the other, so as to bring the words STOMACH PIPE in a line with the word OPEN, or the words BASIN PIPE and the word OPEN in a line with one another, indicating that the communication is open either with the

stomach or with the basin; and only a very slight rotation of the right hand is required to effect this alternate change.

The two short tubes to which the stomach and basin pipe are fixed, project straight out at the end of the syringe, having no angles or turns in them; the full bore of each is open alternately, and the other shut. When the milled nut is taken off the end, the hand-cylinder, with the outer piece of brass, draws off the barrel, when both the ground surfaces are exposed to view, and can be cleaned in a moment if required, and as easily refixed for use.

The instrument is simple in construction, and has not any part which is liable to be out of order or to harbour dirt. The stomach and basin pipe are so fitted that the one cannot be put on to the place intended for the other, and the hand-cylinder can only be put on in the proper way, in consequence of the stops; so that the pipes, and the words relating to them, are sure to be properly adjusted when the instrument is prepared for use. The syringe is perfectly uniform in its external appearance, being a straight barrel, with two tubes, half an inch long, projecting from its end; and may, in the strict sense of the word, be said to act without either valves or stop-cocks. The hands never require to be moved from their hold, and the course of the fluid acted upon is reversed at any moment, and with perfect ease, by a moderate turn of the right hand, the words engraved on the syringe telling which pipe is open. Supposing it is intended to inject the stomach, the piston is to be drawn out, with the words BASIN PIPE and the word OPEN in a line; the syringe being full, the words STOMACH PIPE are to be opposite the word OPEN, and the piston forced into the barrel, when the fluid will pass into the stomach. The syringe can then be filled again from the basin, as just described, and so on. Or, by reversing the order of action,—viz. drawing out the piston when the words STOMACH PIPE, OPEN, are in a line,—the fluid will be drawn from the stomach. The course of the fluid is changed at any moment, by reversing the direction of the piston-rod,—viz. by forcing it in or drawing it out. This will be found a sufficient description of the principle of construction, and method of using the instrument; and, by reference to the accompanying engraving, a further elucidation will be obtained.

In a paper, which was published in the "London Medical and Physical Journal" about two years ago, on the subject of the Stomach Pump, or Poison Syringe, I expressed the reasons why such instruments on the valve principle were all to be condemned: first, because the direction of the fluid acted upon cannot be reversed without removing and changing the position of the pipes, which reverse is continually necessary in extracting the contents of the stomach, in consequence of the end of the stomach-pipe becoming often stopped up by the lumpy and fibrous matter which the stomach so constantly contains. Secondly, because the valves must in a degree obstruct the passage of a thick, lumpy, and fibrous pulp, and even be occasionally propped open by the same. And, thirdly, because valves may be out of order, and rectifying them requires considerable attention. But I repeat, by far the most important and insurmountable objection to valves is, that the course of the fluid cannot be alternated with expedition, which every practical man must know to be absolutely essential during the extraction of the contents of the stomach. I stated, in the paper here alluded to, that valve syringes were elegant instruments, where the passage of clear fluids only was required. Under this conviction, founded upon experience in the use of the stomach pump, I recommended one with a double stop-cock, moved by the fore-finger of the left hand, whilst grasping the syringe, so that the pipes were alternately opened and shut by each movement of the finger. This instrument has been publicly noticed by a writer, who stated *that valves were the only things to be recommended in the construction of a stomach pump*. These assertions, however, are not to be taken on the authority of the maker of the instrument, but experience and observation alone must decide.

Syringes on the stop-cock plan afford free passage to thick and fibrous pulp; the course of the fluid is instantly changed by reversing the direction of the piston; and, had the mode of alternately opening the cocks been sufficiently easy and simple to the operator, at the same time there being no complication in construction, the instrument would have been perfect: but, as I have not seen all these points satisfactorily accomplished, I have turned my attention to the subject, and take this opportunity of submitting my improved syringe to the opinion of the medical profession; and only request that it shall have a fair and impartial trial and examination,

knowing that its fate will then depend upon its merits or demerits. This syringe, from the freeness of its passages, and from their being no part in it which can harbour dirt, is recommended for the injection of large anatomical subjects; as a syringeful of injection could be repeatedly forced in without removing it from the vessel tube, and hence all breaks in the injection would be avoided, and the operation expedited. I shall now only add, that the instrument is applicable for all purposes where rather a large syringe is convenient.

The syringe is recommended to be eight inches and a half long, and the barrel two inches in diameter; the other parts larger than the drawing, in the same proportion. The barrel in which the piston moves, and also the hand-cylinder of the stomach pump, constructed according to this principle, should be made of Birmingham-drawn brass tubes, and the rest of the brass-work turned to fit, and soldered to the same; on this plan, the instrument would be executed in an accurate and elegant style, and might be sold at as low a price as any hitherto offered to the public.

Description of the Engraving.

A the milled nut which keeps the hand-cylinder B in its situation on the barrel of the syringe.

C C the two sockets, with a portion of the elastic stomach-pipe attached to one, and a portion of the basin-pipe affixed to the other: these sockets fit on to the projecting tubes D D.

E F represent the surfaces which are ground together of the two circular pieces of brass at the bottom of the syringe, in which the position of the holes is displayed. The centre circle in E represents the pivot which moves in the hole shown in the centre of F.

G H denote the groove and pin forming the stop. These two circular pieces of brass are represented as detached from the ends of the cylinders, to simplify the engraving.

THE BOAT OF NEW CONSTRUCTION—(see pp. 86, 268, 293, Vol. VII.)—SHIP-BUILDING GENERALLY.

Sir,—I was not aware that my remarks in your 192d Number, upon the "Proposed Plan for a Boat of New Construction," would be considered at all *sour* or unjust, until I saw the communication of A. B. W. in reply to them (No. 194). I have again carefully examined my former remarks upon the subject, and I must acknowledge that I cannot at present perceive any thing but what is substantially correct, as to the striking similarity of principles exemplified in the "Flying Proa" and the "Boat of New Construction." In my former communication I noticed the points of resemblance in the most important parts of construction, and left you to draw your own conclusion as to the correctness of my previous remark, "that there is no *solid* or substantial difference between the construction of the proposed boat and that of the flying proa of the Ladrone Islands." A. B. W., it seems, will not acknowledge that there is more than one point in which the proposed plan and the proa agree; yet, unfortunately, it so happens that this single point of agreement is the principle upon which the weatherly quality depends, as it regards the hull of the boat. I am aware that your correspondent mentions several details in which they do not agree; but this ought not to be hastily admitted as substantial proof of the originality of A. B. W.'s invention. The first point in which it is stated that they do not agree, is the *depth*. This excessive depth is the consequence of local circumstances, and is for the purpose of keeping the crew dry and in safety when landing in or crossing broken water. If A. B. W. is acquainted with the naval architecture of the Eastern seas (in the region of the trade winds), he will recollect that all their sea-going boats are deep in proportion to their breadth. I will instance the Mausoolah boats: these boats are able to cross the surf, and land, at times when no European boat could possibly live. This great depth is, then, a consequence of local circumstances, and not an error in the construction; and, in order to preserve in the proa the important advantage which this great depth has given them in one case, they are under the necessity of having an out-rigger—*not because other means would not give the requisite stability, but because they could not obtain sufficient stability in any other way*

excepting by the sacrifice of that most important property—safety in broken water. Your nautical readers are well aware that this is a most important consideration in open vessels; and that too often boats are swamped by the weather-water breaking into them in consequence of too much stability. With these views of the flying proa, I am induced to conclude that its construction is such as is exactly suited to the weather in the seas where it is used, which is not always moderate, but is *sometimes heavy*.

With regard to its capacity being urged as a point in which it is dissimilar, I cannot conceive how it can in any way affect the principle of construction. I might as well argue, that because a Gravesend boat is not capable of carrying so much dead weight as a frigate or seventy-four, that therefore the principles of construction are essentially different.

It was not my intention to trouble you with these remarks on A. B. W.'s letter in your 194th Number; but, after calling at your office twice when last in town, as I was not able to learn A. B. W.'s real name and address, I was determined to state, through you, my reasons for remarking with so much severity (as he considers it) upon what I deemed to be an unacknowledged plagiarism; and also to endeavour to impress upon A. B. W. the necessity of noting, in all nautical investigations, which peculiarity is the consequence of circumstances and which the result of principle. For instance, Dutch doggers have full bows and round sterns above water, in common with all the Dutch coasters. This is a consequence of local circumstances; but as some Dutch doggers sail so much better than other coasting vessels, we must look for the cause of the difference in the construction of the hull below the water, and we shall find that there is the same principle observed in their construction as in fast-sailing cutters, although not to the same extent.

There is one point of A. B. W.'s letter, which, in justice to myself, I must notice; it is, that I have charged him with boasting, at least by implication. I cannot find that I did so; though I confess he appeared to me to express a little something like exultation at the success which would follow on the adoption of *his principle* of construction, which, I contend, is fundamentally the same as that of the Ladrone Islanders in all the essential qualities of being weatherly and sailing fast. Whether I am acquainted with A. B. W. I cannot tell until I know his real name and address; and were it not that I commenced the remarks upon his plan under the signature of G. B., I should feel no hesitation at subscribing my name and address to this communication.

In my former communication (No. 192, p. 268), I suggested a mode of study which appeared to me likely to be beneficial to the student in naval architecture, and proposed a query which, I am sorry to observe, none of your readers appear to think worthy of solution. Chapman, in his "Architectura Navalis," has some very elaborate investigations bearing on the subject, more particularly those in which he proposes to calculate the resistance offered by the fluid to the different parts of the bottom. Of course the correct solution of this problem would elicit a *principle* of construction which might be depended upon in all cases. I do not mean that in consequence of such general principle all vessels would sail equally fast, but that the shipbuilder who made himself master of the true principle of construction would be able to construct his plans so as, with great burthen, to preserve the greatest proportion of sailing quality which burthensome vessels can have. My attention has been directed to this subject for the last fourteen years, and I have certainly formed my own conclusions on the subject; but as I am so circumstanced as to have little or no communication with men of science, so as to be able to discuss the point with them, I will not venture, at present, to state what these conclusions are. I would wish your nautical readers, however, to under-

stand, that it is not because I am doubtful of their correctness that I am backward to state them, but because I conceive much less attention has been paid to the theory of construction by merchant builders generally than ought to have been the case; and that therefore any suggestion coming from a merchant builder, which might, in any way, tend to improve the science of ship-building, would be likely to be entertained with suspicion by those whose principal study is the theory of naval architecture as applied to our men of war. With regard to the School for Naval Architecture at Portsmouth, it is impossible for me to form any idea of the improvements in construction which have been made, and the additional correct information on the theory of naval architecture which has been collected, since the establishment of that national academy; but that the great naval architects of the day are not agreed as to what are the true principles of construction, is evident from the experiments which are making of the plans of different projectors. I could wish there were a medium of communication (similar to what the medical profession enjoy) established for the professors and amateurs of naval architecture, so that, by the frequent interchange of observations, something like correct data might be obtained for construction. I should wish, also, to see less of that exclusive spirit which so frequently manifests itself in some of the gentlemen who belong to Government yards, as if it were a matter of necessity that all persons who did not serve their apprenticeship in one of His Majesty's dock-yards must be profoundly ignorant of naval architecture. This feeling certainly does not now exist quite to the same extent it did during the late war, as I am happy to be able to testify from personal knowledge; and that it exists at all, is to be attributed, I conceive, to the want of a common medium of communication and to not recollecting that, in time of peace, the arts of peace are more agreeable and attractive than those of war.

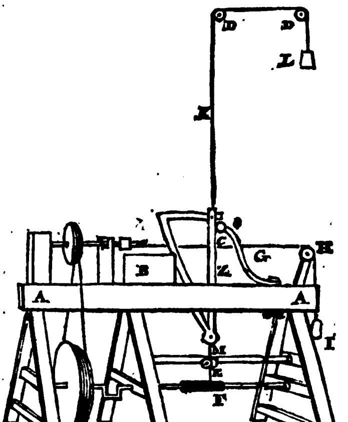
I am sorry to have occupied so much of your room, but I trust the importance of the subject generally will be a sufficient apology. I beg to assure your correspondent, A. B. W., that however severe my remarks may appear to him to be, I have no intention of hurting his feelings, but am actuated by a desire to counteract what I consider to be a pernicious habit of borrowing the original principle of an invention to grace some merely trifling alteration in detail.

I am your's, &c.

G. B.

July 5, 1827.

SCREW-CUTTING APPARATUS.



Sir,—I should think that the mode of cutting a screw which I describe by the prefixed drawing, might be found useful to young turners.

A is the frame of the lathe, (the mandril, wheel, &c. need no description).

B the base of the slide rest; the rest and tool are omitted. The rest must be made to slide easily, and not drawn forward by a screw; but to the back of it is affixed a small cord G, passing over a pulley H, and kept strained by a weight I.

C is the inclined plane which forms the screw, the inclination of the angle of which may be altered

according to the fineness of the screw. Against the inclined side of this, the rest and tool are constantly pressed by the weight I attached to the cord G, proceeding from the end of the rest. The inclined plane C is drawn down by the cord M attached to the lower end of the said plane, and passing over the cylindrical roller E to the cylinder F, fixed on the shaft of the great wheel. The said plane passes through a groove in the frame, against the end of which groove, or against an iron roller fixed in such groove, the back of the inclined plane presses, and is again supported on the upper part by the stay *o*, having a grooved pulley of iron or brass for the back of the inclined plane to rest against. K is a cord passing over the pullies D D, fixed to the ceiling, and strained by the weight L.

Now, it will be obvious, that on turning the great wheel, the revolution of the cylinder F, fixed on its axis, will, by drawing the cord M round it, pull down the inclined plane (which will always be kept in its true position by the groove in the frame of the lathe, the pulley cord K, the weight L, and the stay G); and as it descends it will push forward the rest and tool, which are constantly pressed against by the cord G and weight I. The number of turns (one would probably be sufficient) of the great wheel, must be regulated by the length of the screw or the fineness of the worm. I need not add, that the wheel must not continue to revolve, but must be returned to its original position, unless the screw is sufficiently cut by the tool passing over it once. This apparatus may be fixed to or removed from the lathe in a few minutes. The proportions of the whole must be regulated by the will of the person using it.

I am, Sir,
Your obedient servant,
A. W.

DOCK-YARD QUARTERMEN.

Sir,—Every innovation in a long established system will be met by more or less opposition, whatever degree of good it may impart; and when revolutions of an extensive nature take place, they will be decried by the parties affected thereby as subverting every good, and entailing sure destruction. The dock-yard quartermen alluded to by your correspondent C. W. E. in No. 204, were a useful set of men; but it does not follow that the adoption of a new mode may not produce a better.

If C. W. E. and his "friend" will consult the 3rd and 4th volumes of your Magazine, they will find various papers which explain most satisfactorily the reasons which led to the establishment of the Portsmouth Academy. Nor can there be a doubt that the new system adopted must eventually be productive of essential service, unless intellect well regulated is useless, and unless practice and theory are so opposed to each other that they cannot go hand in hand. Nothing can be more liberal than the principles on which this establishment is conducted; its inmates are of all ranks, from the sons of Commissioners of the Navy down to the sons of Quartermen; and all persons, not excluding even the working shipwright, are entitled to offer their children as competitors for admission. This admission is *entirely* obtained by *ability*, as vacancies occur; whereas workmen were of old not unfrequently promoted to be quartermen through mere parliamentary interest. That any mystery exists in the practical art of ship-building, or that the greater portion of a man's life is necessary to its acquisition, it would be ridiculous to suppose. From seven to ten years of well-regulated application is required at Portsmouth College for an officer's appointment; and that this is fully adequate to the purpose, is proved by the fact that the promotions have taken place in regular succession; which shows, also, that no undue influence is allowed to interfere with the public good. It deserves further to be mentioned, to the honour of the College, that the Honourable East India Company have appointed one of these new system gentlemen

to be one of their surveyors; thus assisting to confound prejudices which should die away in this enlightening age.

I am, Sir,
Respectfully your's,
X. Y. Z.

MOMENTUM OF FALLING BODIES.

Sir,—In your 204th Number, p. 7, a correspondent asks for an explanation of the cause of a cubic inch of wood and one of lead not reaching the ground in the same time, if let fall from a height, since it is a rule that "all bodies fall near the surface of the earth through 16¼ feet in the first second." This rule only applies to bodies falling in a space void of air. If your correspondent had let his cubic inch of wood and lead fall from the top of a glass cylinder placed over an air-pump, and exhausted of air, he would have found them to fall in exactly the same time: even a feather will fall as quickly as a guinea in this situation. When air is present, it buoys up the lighter body, and consequently retards its descent. Any philosophical instrument maker will furnish your correspondent with apparatus by which the truth of this rule may be proved. I beg leave to refer him to the first Treatise of Mechanics of "The Library of Useful Knowledge," for full information on this subject.

I am, &c.
T. C. E.

THE CHAIN PUMP.

Sir,—Your correspondent, J. M. N., in his description of the Chain Pump, at page 445, says, the valves "pass downwards through a wooden tube, and return upwards in the same manner on the opposite side;" and refers your readers to the drawing, which, indeed, corresponds with his description. This, however, is far from being an intelligible description of a chain-pump.

The fact is, the buckets do "pass downwards," &c. &c., as described by J. M. N.; but they return upwards on the other side through the *pump-barrel*, which is smaller than the rest of the tubing, and which they *completely fill;* thus causing the action of the pump.*

J. M. N. also says, the chain pump "is nevertheless an imperfect machine, and liable to many accidents." For a refutation of this assertion, and also for an admirable description of this useful machine, I refer your readers to Nicholson's "Operative Mechanic."

Your's respectfully,
W. B. jun.

July 23rd, 1827.

DOCK LEAVES *versus* NETTLES.

Sir,—Your correspondent under the signature of *Rusticus*, in your *Royal Number*, p. 30, asks for a cure for the stings of nettles. Nature having generally given an antidote for every grievance, persons stung by nettles may find a remedy by rubbing the parts affected with the common *dock leaves*.

If this cure is not of too trivial a kind for your pages, perhaps its insertion may afford relief to *Rusticus*, (Qy. is a *rustic* ignorant of the uses of the dock leaf?) and others of your numerous readers.

I am, Sir,
Your's, respectfully,
J. R. Prior.

Islington, Aug. 1, 1827.

LIST OF NEW PATENTS.

Henry Raper, Esq. of Baker-street, Marylebone, Middlesex, a Rear-Admiral in the Navy, for a new and improved system of signals: first, for communicating by day, by the means of flags and pendants, between ships at sea, or other objects, far distant from each other; in which system the colours of the flags and pendants which have heretofore served to distinguish the signals one from another, and which by distance, or other causes, are extremely subject to be mistaken, may be dispensed with altogether; and, secondly, for communi-

* The "buckets" are commonly and more properly termed *leathers;* the pump-barrel or chamber is circular, and the tubing or back-casing square.—Edit.

cating by night between ships at sea, and other objects far distant from each other, by the means of lights; and which system of signals is more conspicuous, expeditious, and certain, than any which has hitherto been employed for the like purpose. Dated June 21, 1827. *(Two months to enrol Specification.)*

JAMES MARSHALL, of Chatham, Kent, Lieutenant in the Navy, for improvements in mounting guns or cannon, for sea or other service. Dated June 26, 1827. *(Six months.)*

JOHN FELTON, of Hinckley, Leicestershire, machine-maker, for a machine for an expeditious and correct mode of giving a fine edge to knives, razors, scissors, and other cutting instruments. Dated June 28, 1827. *(Two months.)*

THOMAS FULLER, of Bath, Somersetshire, coach-maker, for improvements on wheel carriages. Dated June 28, 1827. *(Two months.)*

WALTER HANCOCK, of Stratford, Essex, engineer, for improvements upon steam engines. Dated July 4, 1827. *(Six months.)*

WILLIAM WILSON, of Martin's-lane, Cannon-street, London, hat-manufacturer, for the means or principle of extracting spirits and other solvents used in dissolving or rendering malleable gums of various kinds, and other articles employed for stiffening hats, hat bodies, bonnets, caps, and divers articles of merchandize, and converting such spirit (after rectification) into use. Dated July 4, 1827. *(Two months.)*

RENE FLORENTINE JENAR, gent. of Bunhill-row, for improvements in lamps. Dated July 4, 1827. *(Six months.)*

GEORGE POULTON, of Stafford-street, Old Bond-street, Middlesex, tailor, for an instrument, machine, or apparatus for writing, which he denominates a self-supplying pen. Dated July 4, 1827. *(Two months.)*

THOMAS SOWERBY, of Change-alley, Cornhill, London, merchant, for improvements in the construction of ships' windlasses. July 4, 1827. *(Six months.)*

RENE FLORENTINE JENAR, of Bunhill-row, gent. for a method of fitting up with metal, or other suitable materials, the holes or interstices in wire gauze, or other similar substances, which he denominates metallic linen. Dated July 4, 1827. *(Six months.)*

JOHN SNELSON SHENTON, of Husband Bosworth, Leicestershire, plumber and glazier, for improvements in the mechanism of water-closets. Dated July 12, 1827. *(Two months.)*

EDWARD BARNARD DEEBLE, of St. James's-street, Westminster, Middlesex, civil engineer, for his new construction or constructions, and combination or combinations, of metallic blocks, for the purposes of forming caissons, jetties, piers, quays, embankments, light-houses, foundations, walls, or such other erections to which the same metallic blocks may be applicable. July 12, 1827. *(Six months.)*

ROBERT VAZIE, of York-square, Middlesex, civil engineer, for improvements in certain processes, utensils, apparatus, machinery, and operations, applicable to the preparing, extracting, and preserving various articles of food; the component parts of which utensils, apparatus, and machinery, are of different dimensions, proportionate to the different uses in which they are employed, and may be separately applied in preparing, extracting, and preserving food, and in other useful purposes. Dated July 12, 1827. *(Six months.)*

GEORGE ANTHONY SHARP, Esq. of Putney, Surrey, for an improved table urn. Dated July 18, 1827. *(Six months.)*

ROBERT MOORE, of Underwood, Sterlingshire, for improvements in the process of preparing and cooling worts or wash from vegetable substances, for the production of spirits. Partly communicated by a foreigner. Dated July 18, 1827. *(Six months.)*

THE SAME, for processes for rendering distilling refuse productive of spirits. Partly communicated by a foreigner. Dated July 18, 1827. *(Six months.)*

NOTICES TO CORRESPONDENTS.

The New Grand Entrance into Hyde Park in our next.

The subject of the Patent Laws is unavoidably deferred till next week.

We shall be glad to receive the continuation of Tim Bobbin's description; and if he can accompany it with drawings, he will confer an additional favour.

The Establishment to which J. O. alludes was not brought to maturity.

Communications received from J. H. W.—Carolus—A Friend to Improvement—Mr. Shires—Q.—Luzitanus—T. M. B.—J. O.—Mr. Bevan—S. Y.—W. D.—J. L. S.—T. S. S.

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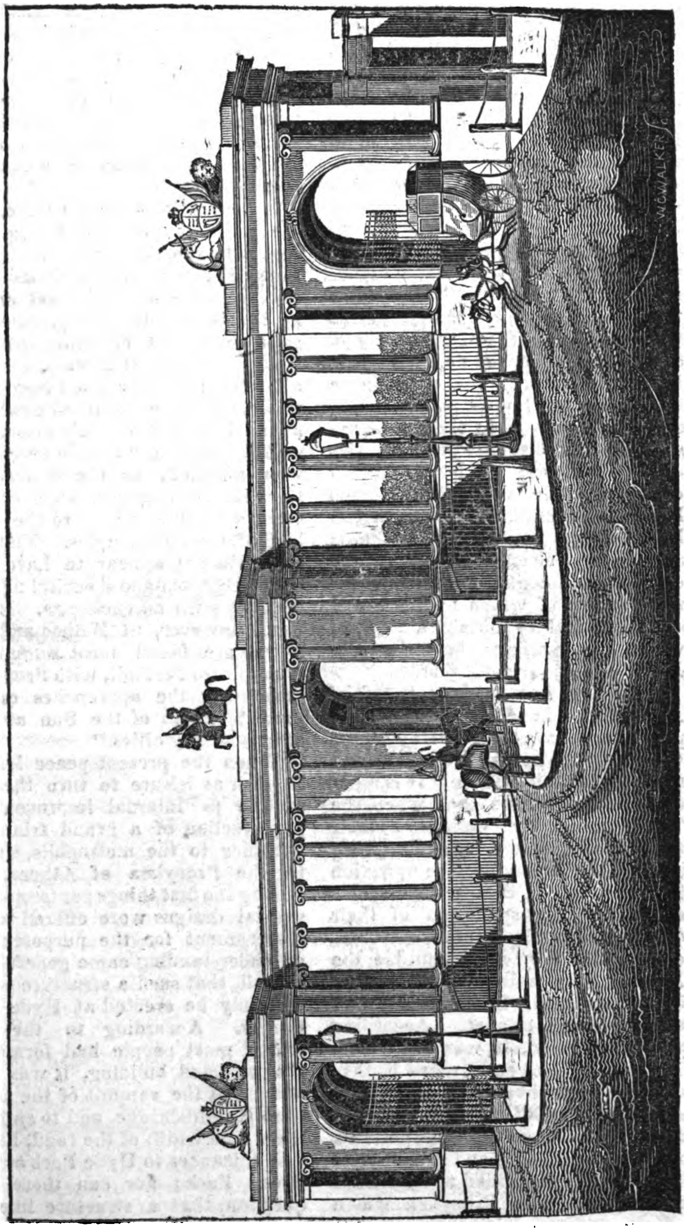
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 208.] **SATURDAY, AUGUST 18, 1827.** **[Price 3*d*.**



NEW GRAND ENTRANCE INTO HYDE PARK.

NEW GRAND ENTRANCE INTO HYDE PARK.

In consequence of the wonderful extension of London beyond the gates which of old marked its limits, and the demolition to which these structures, no longer either in place, or ornamental out of it, have long since been consigned (Temple Bar alone excepted), there is at the present day a remarkable deficiency, in point of distinctive grandeur, about all the approaches to the British metropolis. Although of such vast magnitude, it still wants, if we may so speak, *a beginning.* It is like a spacious mansion without a porch; a splendid oration without an exordium. Nothing of the nature either of portal or barbican (we cannot think of taking a few odious toll-houses into account) arises, to announce to the eye of the stranger his entrance within this queen of cities; he leaves imperceptibly some straggling suburb behind him, and finds himself in the heart of the capital before he is aware of having crossed its threshold, or thinks of looking around him for the wonders of which he has heard so much, and to obtain a sight of which has, perhaps, been the sole object of his journey hither.

Who that has read or heard of Athens, can have forgot the Propylæa, or triumphal gateway, which was the pride of the Athenians and the envy of all Greece? It is mentioned by Æschines, that when the Thebans, at the period of their military ascendancy, were discussing in a public assembly the question how they might best enrich themselves by the spoliation of their discomfited rivals, Epaminondas declared that they could humble the Athenians by nothing so much as by the removal of the Propylæa to the Cadmean citadel. According to Harpocration, it was begun and finished in five years, when Enthymenes was archon, and cost a sum equal to 464,000*l.* English. It was designed and executed by Mnesicles, of whose originality and grandeur of taste it long remained an illustrious monument. The Propylæa was a hexastyle colonnade, with two wings, and surmounted by a pediment. "The elevated position of this structure," says Donaldson, in a note in Stewart's 'Athens,' "its enlarged intercolumniations and spacious vestibules, exposed advantageously to view, in that fine climate, the beauty of the marble and the enrichments of the Lacunaria; and thus procured for it that general admiration which is expressed in ancient authors."

A fac-simile of this edifice, with the exception of the wings, was raised to decorate the first entrance to the Peribolus of the Eleusinium; and, from the researches set on foot by the Dilletanti Society, other elegant examples of Propylæa have been discovered at Eleusis, Sunium, and Priene. There is a Propylæum, also, to the Grecian temple at Pompeii. "Indeed it is highly probable," says Donaldson, "that, where space was afforded, or the finances of the country adequate, such edifices were usually attached to the Periboli of Grecian temples. The *Romans* do not appear to have been very scrupulous about encircling their temples with an enclosure. In the East, however, at Balbec and Palmyra, are found most sumptuous examples of Periboli, with Propylæa, decorating the approaches of the great Temples of the Sun at these extraordinary cities."

When the present peace left the English at leisure to turn their attention to internal improvements, the erection of a grand triumphal entrance to the metropolis, similar to the Propylæa of Athens, was among the first things contemplated: several designs were offered to the Government for the purpose; and an understanding came generally to prevail, that such a structure would certainly be erected at Hyde Park Corner. According to the idea which most people had formed of the projected building, it was to be erected at the summit of the ascent from Knightsbridge, and to embrace the whole width of the road, having side entrances to Hyde Park and the Green Park; nor can there be a question, that a structure like the

Propylæa, erected in such a situation, would have had a most magnificent and imposing effect. To the everlasting discredit, however, of the spirit and taste which preside over the architectural improvements of this auspicious era, our long-talked of "triumphal entrance" has dwindled into a mere Park entrance, which, like the Palace, "leaves us where we were before," without that important addition to the metropolis so fondly anticipated and so much wanted.

The Park Entrance, however, considered as an entrance into *a Park*, must be allowed to reflect great honour on the designer and builder, Mr. Decimus Burton. For the prefixed engraving of it, as well as for the following "Description" and "Remarks," we are indebted (as in the case of the Palace) to Mr. Davy, the talented Professor of Architecture to the London Mechanics' Institution.

Description

The new entrance to Hyde Park consists of a frontage of about 107 feet from one foot entrance to that of the other. There are three arched carriage entrances. On either side of the central entrance there is a peristyle plinth four feet nine inches high. The central entrance has a bold projection. The entablature is supported by four columns; the volutes of the capitals of the outside column on each side of the gateway are formed in an angular direction, so as to exhibit two complete faces to view (for Greek authorities, see Ionic Temple on the Illissus and the Erectheum); the soffit of the arch is decorated with coffers, the outside styles of which are separated from each other by neat rows of beads; the blank spaces, from the springing of the arch to the top of the plinths, are furnished with a small niche on each side. The two side gateways, in their elevations, present two insulated Ionic columns, flanked by antæ; the intrados of these arches are relieved by a continued pannel as far as the plinth; each of the arches has an archivolt surmounted by a neatly carved console. All these entrances are finished by a blocking, to receive an equestrian figure of Geo. III., and other emblematical trophies. The foot-gates are six feet three inches wide, and flanked by piers of three feet; the carriage-gates, ten feet six inches wide in the clear roadway; the plinth for the insulated Ionic columns and antæ, seven feet one inch each; ditto for the central or King's entrance, ten feet wide; the peristyles, of five columns on each side, thirty-one feet three inches.

The *gates* are of iron, and present an admirable specimen of the perfection to which architectural constructions of this metal may be carried. The design consists of a beautiful arrangement of the Greek honeysuckle ornament, the model of which appears to have been executed with the greatest care. The parts are well defined, and the raffles of the leaves brought out in a very extraordinary manner. In the construction, or hanging of the gates, also, some considerable improvements have taken place. One consists in preventing the cup, which the wrought iron bar turns into, from being filled with dust or water, and thereby hindering the free motion of the gates: another improvement is, that when the gates are thrown open, the iron stop (so dangerous to the hoofs of horses, &c.), by the action of a lever, immediately sinks to the level of the road, and when the gates are closed resumes its situation. The gates are bronzed, and fixed or hung to the piers by rings of gun-metal. They were manufactured by Messrs. Bramah.

Remarks.

It will, no doubt, be a source of general regret, that the architect of this gateway (showing, as he has done, a taste decidedly superior to most others) had not the opportunity afforded him of perpetuating his fame by an edifice of a more extended character. Every praise is due to the present structure: it exhibits what we rarely meet with—variety in the midst of uniformity, and a general combination of great chasteness and elegance. The defects complained of in the late beautiful screen before Carlton-house have been judiciously avoided; the columns are not raised so high as to exclude a view of the objects beyond them. Although the three carriage-entrances are of equal dimensions in point of roadway, the adoption of the insulated columns and the antæ in the side entrances, in contradistinction to the portico entrance of the central part, has the effect of producing an apparent difference, and cannot fail to give undivided satisfaction.

When the triumphal arch on the opposite side of the road * is complete (the

* The arch alluded to is a gateway, or sort of lodge, to the New Palace which is now in the course of erection. We shall

place, in fact, from which the present screen should be viewed), the grouping of the architecture will be altogether extremely novel and striking.

[The frieze of this gateway, which has been designed by Mr. Henning, jun., son of Mr. Henning (so well known for his admirable models of the Elgin marbles), and which has been described to us as possessed of great merit, is still in the course of execution. As soon as it is finished, we shall lay an accurate copy of it before our readers.—EDIT.]

Additional Remarks by the Editor.

It will, probably, have occurred to the reader, when perusing our preliminary observations on the deficiency of distinctive grandeur in the approaches of the metropolis, that we ought at least to have excepted the entrance by the Bridges. But if the classical authorities which we have quoted have inspired him with the same *beau idéal* of a suitable entrance to a great city which we entertain, he will perceive that it is by no means, even in these places, realized. Take Waterloo Bridge, for example; it is the noblest of all the bridges (as yet erected), and noble too is the line of road by which you approach it—a mile nearly in length, broad, straight, and ascending gradually to an elevation which commands the whole of the city side of the river. Now, to know what is wanting here, let the reader only picture to himself what would have been the effect produced, had a triumphal arch of some hundred feet high been thrown across the summit of the road, at the entrance to the bridge; supposing always the buildings on both sides of the road completed, so as to exclude any lateral glimpses of the city. How magnificent would such an archway have appeared in the distance! How various and striking the assemblage of objects which would have all at once burst on the traveller's sight, as he passed beneath its lofty span! The whole of the metropolis, from the picturesque turrets of St. John's, in the West, to the endless forest of masts which darken the East; Westminster Abbey, St. Paul's; lesser spires and turrets innumerable; Richmond and Adelphi Terraces, Somerset-house, the Temple and its gardens, the spacious Thames flowing beneath, skimmed by many a busy skiff, and bestrode on either hand by bridge after bridge, each excelling the other in magnitude and grandeur!

When one compares, indeed, the effect which a triumphal gateway on this spot would have had, with the utmost that could have been expected from the erection of one at Hyde Park Corner, it seems a matter of surprise that the superior capabilities of the former situation should have been for a moment overlooked. Could any thing besides have corresponded better with the triumphal name of Waterloo Bridge, than a triumphal arch, which, by its emblematic embellishments, might have assisted to commemorate the same glorious event? It might have deserved consideration, too, that for one foreign traveller who enters London by Hyde Park Corner, there are at least a dozen who enter it by one or other of the bridges; from all of whom that bridge which furnished the best view of the British metropolis would, of course, have been certain of a preference.

May we venture to hope that, since Hyde Park Corner has lost the honour designed for it, and since a triumphal entrance to London is a thing still to be accomplished, the claims of Waterloo Bridge to the distinction will yet receive that consideration which they merit? Or should its erection on that spot be now inconvenient, would not the opening of the approaches to the New London Bridge furnish an excellent opportunity for adding so noble an ornament to the metropolis?

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give a view of it, also, in an early Number.—EDIT.

VALLANCE'S NEW MODE OF CONVEYANCE.

Sir,—I do not mean to enter into any controversy with B. C. (Vol. VIII. page 35), as to the most proper tone for stating an opinion or asserting a truth; nor should I

have conceived his remarks required answering, but that, like many other writers of his class, he quotes the words of his opponent in a way which gives them quite a different meaning from the one intended by their author.

My remarks at the beginning of my last communication (Vol. VII. page 412), express feelings which I fancy exist in the bosom of every one who is interested in the progress of science, and is a friend to genius; and an opinion that a man who seeks patronage for a crude undigested scheme, without having duly considered all the difficulties attending it, is either a "visionary," or, as B. C. expresses it, "a knave;" an enemy to real merit, and one deserving exposure: but if B. C. entertains a different opinion, he is quite welcome to it.

Those who will take the trouble of reading my last letter, will perceive that B. C. has either misunderstood or misrepresented its meaning. They will find the assertion, "with the air of a master he puts forth his dictum," altogether uncalled for, inasmuch as I put forth no "dictum" about the matter: I declared my "*firm conviction* that it was in every respect inferior to a railway," and I see no reason to alter my opinion.

As to railways, I conceive I have proved to those who have taken the trouble of going over the calculation, that a carriage moving ten miles in an hour will require the expenditure of ten times the power, *per mile*, that the same carriage moving one mile in an hour will require—the resistance of the air excluded in both cases; which is all I attempted or intended. Now, it has been publicly asserted, since, that the Scotsman never meant to contradict this, but only to prove that the same carriage could be moved over the same space, at the same expense of power, let the velocity be what it would—the air's resistance excluded as before. But why any one should be at the trouble of writing so much, and abusing so many, merely to prove that a one-horse engine working ten hours, is an expenditure of power equal to a ten-horse engine working one hour, I am altogether at a loss to imagine.

The shameless misrepresentations to which most of the advocates of this plan have had recourse, are completely eclipsed by B. C. He must certainly *know* that he has nothing to authorize his insinuating that I believe it possible for a locomotive engine to travel at the rate of 100 miles an hour; nor did I ever say a word about "ordinarily constructed coaches or caravans;" nor did I ever express my belief that a carriage could be moved at that rate by *any means whatever*. Without hesitation, he attributes opinions to others, which they never declared or thought of; and, after all, he has not *removed one objection to the plan!!*

But the fact is, the ordinary modes of conveyance on railways are sufficiently common for persons in general to be acquainted with the circumstances which limit their application. Whereas this is a new scheme, which no one *knows*, from the evidence of his *senses*, will fail, but which can *reasonably* be expected to do nothing else. And it is remarkable, that none of its champions have hitherto shown any knowledge of the principles to which it must be subservient. Not one of them has met the objections started fairly and candidly; they all satisfy themselves with ridiculing their opponents, or studiously exhibiting feelings of contempt for them and their opinions. This is evidently the feeling which B. C. wishes to have it thought he entertains, and which he labours to excite in others; to attain which object, he sacrifices truth and justice without mercy or scruple. But this, Sir, is not argument; and poor, indeed, must that cause be, whose advocates can find no better means of supporting it.

B. C. says he is likely to offer some "observations with a view to strengthen confidence," &c. &c. He has prudently *given up* all the points in dispute, except the *possibility* of driving the carriage at the rate of 100 miles an hour, *putting expense and convenience entirely out of the*

question. There are good reasons for believing, that the plan will never answer either for that velocity, *or any other,* in a tube so much as *two miles long.* Should, however, his "observations" have the effect of altering my opinion, I shall be very happy to acknowledge it. But I beg to remind him, that proving all the tried methods incompetent to attain the desired end, will not prove the proposed plan the reverse; and to suggest, that if he wishes to establish the probability of its success in the opinions of rational men, he may possibly find that reasoning will answer his purpose better than personality.

Your's respectfully,
S. Y.
A Young Engineer.

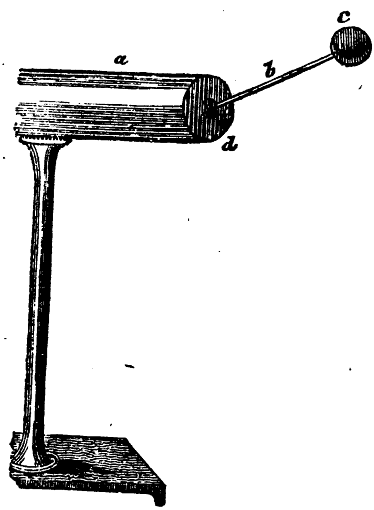
SERIES OF PHILOSOPHICAL EXPERIMENTS, AND ILLUSTRATIONS OF APPARATUS, ON SIMPLE PRINCIPLES.

BY MR. W. H. WEEKES.

(*Continued from p. 229, Vol. VII.*)

NO. VIII.

Electricity—Universal Ball-Conductor.



In the performance of numerous electrical experiments with machines furnished with the usual appendages, an inconvenience is frequently experienced by the operator, consequent on the difference of altitude at which the prime conductor of the machine is often found to be elevated above, and occasionally beneath, the knobs, &c. of Leyden jars, and other apparatus, to which it becomes necessary to communicate a charge or succession of sparks. To remedy these contingencies, books, blocks of wood, and other temporary and unsteady supports, are of necessity resorted to by the experimentalist, who needs not to be told that his views are thereby frequently defeated, and the power of his apparatus limited in its utility. In the ardour of research, when experiments multiply with rapidity, it becomes important to possess every facility of operating, with as few foreign auxiliaries as possible. In obviating the difficulties, and promoting the objects at which we have above glanced, I have found the simple addition to the electrical machine, which shall now be described, and which is, indeed, easily made, a very useful acquisition. The prefixed engraving represents the conductor *a* mounted, as usual, upon a glass pillar; from the end of the conductor proceeds the stout wire *b*, six inches in length, upon the extremity of which screws the brass knob *c*, which should be, at least, two inches in diameter, whence the transmission of a *large* spark, when wanted, will be rendered more certain. The wire *b* originates from a universal ball-joint, securely connected, by means of a screw, with the end *a* of the conductor, every part of the surface of this additional apparatus being well polished, and entirely free from points and sharp edges.

The principle of that excellent invention, the *universal joint,* adapted to all kinds of motions and flexures, is generally understood, and therefore need not be here described. By its use in the present instance, the ball *c* may be moved without the least difficulty, either vertically or horizontally, and brought to any point of the circumference of an imaginary hemisphere

whose radius is about seven inches; consequently the ball has a range of full fourteen inches, within the limits of which almost every description of electrical chemical apparatus, &c. may with facility be adjusted.

(To be continued.)

THE IRIS.

Sir,—In No. 186, page 153, your correspondent, Mr. James, has given a clear and plain description of the human eye. In the course of his lecture (if I may be allowed the expression) he has not omitted to notice the beautiful structure of the iris; he remarks that "it consists of two kinds of muscular fibres, one of which are extended from its extremity like the radii of a circle, and point towards the middle of the pupil as to a centre; and the other which are circular, and surround the pupil, having the middle of it for their common centre:" and then he proceeds to explain the effect which the dilation and contraction of these muscles produce. Dr. Paley, in his "Natural Theology," gives the same description; but in a new edition of that work lately published at Oxford, with plates, and notes by Mr. Paxton, M.R.C.S., there is the following observation made by the intelligent and intelligible Editor, which perhaps may amuse your readers:—"Dr. Paley," observes Mr. Paxton, "seems to have adopted the opinion of some of the older anatomists, as Ruysh, Winslow, Dr. Monro, and others, who minutely described two sets of muscular fibres." (Here he gives the description nearly in the words of Mr. James; but he afterwards adds)—"But from more recent investigations, eminent anatomists, such as Blumenbach, Sir E. Home, and Bell, have been induced to give different explanations of this motion of the iris, attributing its contraction and dilation either to the varied impulse of blood into its vessels, or to its own *vita propria*."

Your humble Servant,
CAROLUS.

ON THE SLIDING RULE.

Sir,—In your No. 200, page 388, I have just seen a few observations on the use of the Rule, with some particular remarks on my Treatise on that subject, on which I beg leave to offer one or two observations.

Those who are practically acquainted with the use of the rule, know that to be sure of the first three figures is all that is in general required, and also that for all common purposes the ratio of $\frac{11}{14}$ is quite sufficient for giving the area, from the square of the diameter of a circle.

I do not recollect having used the number 490, except at page 27 in my Treatise, where it is used on the line C over $\underline{25}$ on the line D, to give the area from the diameter, and not upon 24, as quoted by your correspondent; which will be found sufficiently near for most purposes, being within $\frac{1}{56}$, and expressed in whole numbers. I find marked in my own book $\underline{380}$ upon 22, which is, with few figures, as near as your readers can wish.

I take this opportunity of correcting a very mistaken idea that prevails on the subject of my book, which is, that it is specially adapted only to the rules which are sold under my name; whereas the Treatise is applicable to *all* sliding rules—to those used by carpenters and other artificers, as well as to the more improved rule.

There has, for many years, been sold by Jones, Holborn, an improved rule, at a very moderate price, by which almost all the formula in my book can be brought into use. At present I shall not trouble you further.

Your's obediently,
B. BEVAN.

METHOD OF OBTAINING A SUPPLY OF WATER IN CASES OF FIRE.

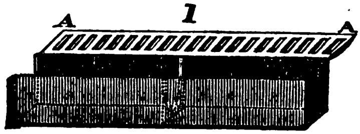
Sir,—Having been particularly attached to the study of fire-engines, I was long since led to remark the trouble and difficulty of getting one

of these useful machines speedily to work, from the formation of our streets; this difficulty is still further increased by Macadamizing, by the biangular pavement, and also by the plan now adopted in Fleet-street.

Few persons have any idea of the difficulty of getting up even the present road paving. I have myself seen experienced firemen, ten, and even fifteen minutes, before they could make a hole large enough to supply the engines with water; and as for parish engineers, they have been obliged to desist altogether. No longer back than last January, at the fire in Cousin-lane, Thames-street, the engineer of Allhallows parish broke two crow bars in attempting to take up the stones, and was at last obliged to work both his engines, as well as he could, from a hose and stand-cock.

I have devised several methods for the removal of this difficulty, one of which I now lay before your readers. It consists in laying down in each street a canal of iron, cast in lengths of three feet, one of which is shown at fig. 1. Interior dimen-

1



sions, 6 inches deep and 6 inches wide. A A a strong grated cover fastened on by hinges. In case of fire, this grating being thrown back, as in the above fig., and the course of the canal stopped, a body of water would be collected therein, from which the fire engines could work. To add to the facility of stopping the canal, and also to its strength, every length should have a semicircular projection in its centre, similar to fig. 2.; and if each engine were

to carry a piece of wood the size of the interior of the canal, by placing it against one of these projections, the water would be immediately stopped, without loss of either time or labour. Fig. 3 is a section of a road provided with these canals; and although it is principally for the supply of engines that this plan first suggested itself to me, yet there are numerous other advantages to be obtained by its adoption.

If this plan were generally adopted, I would suggest a new rose or drain for the section pipes of the engines. For although the present flat or horse-shoe rose would work very well from one of these canals, while the engine stood parallel with it, yet there are numerous occasions on which it is necessary to place the engine at right angles to the course of the water, especially at large fires, when several engines are at work,

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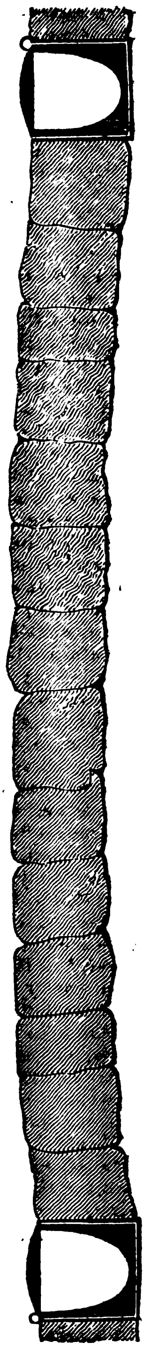

and the road is wide. Fig. 4 will

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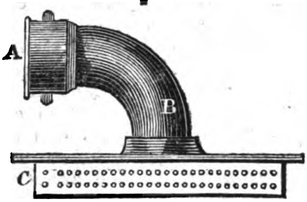

serve to render the construction of this rose understood. A is the swivel screw which unites it with the section pipe; B is a brass elbow fitted into the rose C by a swivel joint, which, by its turning in every direction, will allow the engine to stand in any required position with regard to the canal. The present flat drains vary in depth from 1½ to 3 inches. I should recommend this to be 2 inches deep, 4 wide, and 15 long. Should the above canal be thought too expensive, I subjoin another method, which consists in an alteration or addition to the present iron canal in Fleet-street.

Let every other length have a hole in its centre 18 inches long, 6 inches wide, and 6 inches deep, (see A, fig. 5,) and let a piece be cast to fill this

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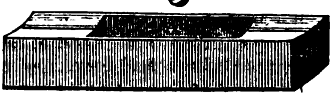

hole, and correspond at the top with the rest of the canal. In case of fire, if this piece be lifted out of its bed, and a plug be opened, a body of water will be collected sufficient to supply one of the swivel roses described above.

I feel that this subject is of infinite importance, and well worthy the attention of some scientific person more able than myself to do it justice; and should I, in this, or any future communications, be the means of furnishing a useful hint to those who will practically apply them, my object will be attained.

Believe me, Sir, your's, &c.

WM. BADDELEY.

July 20, 1827,

10, *George Yard, Lombard-street.*

SUBSTITUTE FOR FIRE ENGINES.

Sir,—I was much pleased with Mr. Baddeley's letter, in No. 205, upon "Supplies of Water at Fires." I think there are some objections to his plan; but if there is a supply in the Water Company's pipes, it is certainly an advantageous way of working a fire-engine. If the stand-cock has a screw with one or two branches, it appears to me, that as many fire-engines could be worked from the plug, and they would not then throw up so much mud with the water as I have seen done at some fires. The other day I walked over Lord Grosvenor's new district at Pimlico, and saw several iron posts, similar to street posts, very nicely contrived, with screws and hose for filling water carts, for irrigating the roads. There was a cock under ground; and I was surprised at the facility and dispatch with which the supply was obtained: the carts were filled in less than a minute. A Chelsea Water-works' turncock was near, and I made some inquiries of him. He informed me the carts held 220 gallons each; the head of water was 70 feet in the pipes, always charged; the posts, he said, were designed by Mr. Simpson, the Company's engineer; and the trustees of the Grosvenor district, at his recommendation, intended to fix them all over their jurisdiction, not only to supply water for the roads, but to extinguish fires without using engines, as they would send out four times as much water as any fire-engine. I expressed my doubts of this, when the man said, if I would go with him to the Trustees' Yard, he would show me one, and set it at work. I accordingly did so; and I there saw a jet spouting at least sixty feet high; which so delighted me, that I thought you and your readers should at least know some parts of London are improving in the means of supplying water at fires. For some days I pondered over a scheme to erect these water-posts all over London; but I was at a loss about the expense; and in writing to you, I conjecture, that if the expected saving of property would not amount to

5 per cent. the Londoners would not sanction the outlay. The Insurance Companies, too, would oppose it; for a clerk in one of them told me the other day that fires did them good, and induced persons to insure.

Your's,

A PEDESTRIAN.

London, July 31, 1827.

THE PATENT LAWS.

Our readers are aware that, with a view to bringing into public view the numerous evils of the existing laws in regard to patents, we recently opened our pages to a discussion of the subject; that after several letters had appeared upon it, a public Meeting, for the purpose of petitioning Parliament for redress, was brought about by some two or three of our correspondents; but that, from the inexperience of the moving parties in matters of this sort, the meeting, though numerous, did little or nothing for the cause, and ended in the appointment of a Committee which also has ended in nothing. While there was a chance of that Meeting, or of the Committee which it appointed, effecting the object in view, we suspended our separate prosecution of it; but finding that nothing has resulted from either, and that the members of the Committee have in fact no intention, *as such*, of doing any thing, we think it our duty take the matter again into our own hands, and to do what we individually can to bring it to a successful conclusion.

We shall now, in the first place, lay before our readers a letter on the question which we have received from Mr. W. Deykes, solicitor. Generally speaking, we differ altogether from Mr. D. on the subject; but his letter is deserving of attention, from the circumstance that he appears to have been in communication with the Government on the subject, and has devised some measure of relief which has been favourably entertained by Government. What that measure is, Mr. D. has not thought proper to disclose; but if we may guess at a conclusion, from the premises on which it seems to have been built, we should judge it to be a measure by no means calculated to satisfy either the justice or expediency of the case.

Mr. D. takes his chief stand on royal prerogative! *We* are disposed to take much higher ground. We hold that there is a right in every man to the fruits of his own ingenuity and labour, which is superior to all prerogative. We know of no solid foundation for prerogative but the better protection of private rights; and to whatever extent it may accidentally subsist beyond that, the sooner it is clipped the better Nay, so absolute and indefeasible do we consider the property of every man in his own thoughts and inventions, that we must confess we could never discover on what principle of justice it has been determined, that an author or inventor is merely entitled to the fruits of his industry for certain limited periods, while all other men are allowed not only to possess the fruits of theirs during life, but to hand them down to their heirs to the end of time. Is it because the productions of man's immortal mind are as nothing, compared with such scrapings of the dust of the earth, as any kindred though sentient clod may call his own? Or is it rather because the empire of brute force, which regards as nothing whatever it cannot grasp and handle, and place under lock and key, has not yet entirely lost its sway amongst us? May we not hope that a time will yet arrive, when mind shall assume its proper station in the estimation of men, and when to cultivate its powers will be found as certain a source of permanent gain, as either ploughing the earth or digging into its bowels? Such, then, being our opinion of the rights of authors and inventors—that the utmost the laws and usages of this country have ever given them falls far short of what they are justly entitled to—we must necessarily hold in but little respect, any plan for their relief, which does not at least propose that the greatest protection which has been given any individuals of the class, shall be extended to the whole. We would have

inventors placed as nearly as possible on the same footing as authors. Books were once published by royal license, in the same manner as new inventions are still protected by letters patent; we would have the exercise of the royal prerogative as to both equally and for ever abolished.

Mr. Deykes takes some other grounds which we think not less exceptionable; but, instead of detaining our readers by a detailed refutation of them, we beg to refer them to the copy of a Petition on this subject, which we have prepared to present to Parliament as soon as it again meets, and which is inserted immediately after Mr. Deykes' letter. It contains, in separate paragraphs, what we conceive to be a fair representation of the grievances under which inventors labour; and, in order to point attention to such of these paragraphs as bear an answer to the questionable points of Mr. D's letter, we have marked the corresponding parts of the two documents with corresponding letters. The Petition will lie for signatures, till the meeting of Parliament, at 55, Paternoster Row; and we shall, in the mean time, be glad to receive any communication of *matters of fact* which may serve to substantiate the statements contained in it.

The members of all country Mechanics' Institutions, and the friends of science everywhere, are earnestly solicited to second our efforts, by getting similar Petitions in readiness. They may either be forwarded (under an open cover) to any Member of Parliament to whom the Petitioners may choose to commit the presentation of them; or if they are sent to us, free of expence, we shall take care that they are put into hands that will do them every justice.

Mr. Deyke's Letter.

Sir,—Having become acquainted with the sentiments of all your correspondents, on what they term the "Patent Laws," through the medium of your pages, and awaited the result of the Meeting which was lately held on the subject, but which proved futile, by reason of attention not having been confined to the real and only ground of grievance, and the immaturity of idea which prevailed; I am induced to offer you a few considerations on the subject, and to invite reflection thereon; that thereby may be induced unity of idea, and consequent, or following thereupon, unity of purpose.

Your correspondents have been so numerous, that I must treat of them and their ideas generally; though, in courtesy, I would prefer to do so individually. The more numerous class, and those foremost in error, are such as complain of the large amount payable for the fees of a patent; and who would remedy the grievance by the single, specific, and simple course, of excessive reduction. How to deal with this class—seeing that I am disposed to admit that the high charge for patents is a grievance, but to deny the propriety of reducing that charge—I scarcely know. The seeming inconsistency in my ideas may, however, be explained by the familiar adage, "of two evils, choose the least." Whether, then, I would ask, is it a greater evil to pay a large but definite sum, which you previously provide for and obtain; or to incur charges of heavier and undefined amount, for which you are unprovided? I allude herein (A) to the certain consequences of reduction; and insist that if patents were easily obtained, inventors, instead of obtaining a privilege, would incur a train of evils,—bills in equity—injunctions—issues at law—special cases, &c. &c. The golden apples to the eye, in expectation, would be bitter cinders to the mouth, in realization; Pandora's box would be in the midst of the artisans,—nay worse: for of old the evils flew off, but left *hope* at the bottom; whereas, in this case, *hope* would speedily evaporate, and leave behind a succession of evils. Need I illustrate consequences so evident? Who, in one part of the country, could be certain that he was not infringing the cheap patent of another man, in a different and distant part?

Illustrations will crowd to every intelligent mind turned to the subject in this point of view.

I have long and anxiously consired the subject in all its bearings; and I maintain that the high charges form no grievance, abstractedly; but relatively, they are a grievance, inasmuch as they obstruct the course of proceeding for a patent. Herein is the true point for consideration—the real and only difficulty; and some of your correspondents have arrived very nearly at this view of the subject. For instance, those gentlemen who respectively suggested—the one, payment by instalments; the other, a commission payment, or per centage on the profits: they must have felt the real difficulty of the question—the real grievance. But, as to their remedies, they are inadmissible, I am convinced, by the Government. What! — a franchise emanating from a prerogative of the crown, to be coupled with payments by instalments, or contaminated by participation in profits. In the latter case, a specific system of Excise would be requisite, to say nothing of other objections. Professing, as I have done, to know something of the subject, I may be permitted to seek to inform others, in order that whatever discussions may transpire, the basis of argument may be founded upon correct principles. Patents are not a right (B.) to the subject; they do not proceed of law, nor are they protected by statute law: but the right to grant them is inherent and unquestionable in the Crown; a high prerogative which, when granted, confers a high privilege or franchise on the individual. The medium of communication between the king and the subject, subsists in the persons of the Lord Chancellor, the Attorney General, and the Solicitor General; under and subject to whom, in their several departments, are various officers; and to all of whom certain and accustomed fees are of right payable on the granting of every patent. Patents are granted upon petition; therefore, if obtained, they cannot be called nor deemed a purchase (as many contend) of the right to avail oneself of one's own ideas; for, on the contrary, every man may avail himself of his own ideas without a patent (C.) It is, in truth and in fact, *an injunction* upon all others; restraining them from seeking to participate with an ingenious individual in the profits and advantages of his individual genius. But should these injunctions be numerous, what would be the state of affairs generally? So bad, that they evidently never ought to be numerous, nor very easily attainable. As I have said, they proceed from the king, as a matter of grace, on the petition of the subject; let me say, also, that they proceed not from the king, as an individual, in gratification of individual feeling, but from the king as the head of the state, and on behalf of the state, and moreover for the benefit of the state;* for what is the express contract which the king, on behalf of the state, makes with the individual? That provided he (the individual) explains fully, clearly, explicitly, undisguisedly, and operatively, his invention, he shall have the exclusive benefit thereof (others being restrained) for fourteen years; and hence arises the necessity of a specification, which of necessity must be (to be any thing) what it purports to be: and in this single observation, are answered those of your correspondents who have speculated upon this branch of the subject.

To return, however, to the grievance which ingenious artisans feel, but cannot clearly comprehend, from not knowing the subject in all its bearings, I shall state it to be the possession of an idea of invention, which they lose their property in if they divulge; of which they cannot avail themselves without a patent; for which patent they have not the necessary money; and which money they cannot obtain without disclosure: thus at every point there is an obstacle.

* Is not this of itself an answer to the preceding paragraph, marked B. ?—Ed.

And how is this state of things to be remedied? Certainly not by reduction! (D) Certainly not by payments by instalments!! Certainly not by an *ad valorem* excise duty on the profits!!!

But, if the above be the real and true state of the grievance, then it may be some satisfaction to your readers to learn, that to obviate the same, a measure has been proposed to the Government, and has obtained consideration. It would be presumptuous to speculate upon the probable result of the measure, and no less indelicate and improper to state the nature of it; but if (as I have said) the real evil is felt to be such and the same as I have described it, the mechanics and artisans labouring under, and feeling the difficulty of their situation, are in their own judgments to decide whether or not it is expedient for them to petition the legislature for a remedy; and it will be for the legislature to determine, in its wisdom, whether the measure referred to, or any measure of superior merit, will afford the proper remedy.

I am, Sir,
Your obedient Servant,
W. DEYKES.

24, *Essex-street, July* 11, 1827.

PETITION.

To the Right Honourable the Commons of the United Kingdom of Great Britain and Ireland, in Parliament assembled, the Petition of the undersigned Inhabitants of the City of London and Westminster, and parts adjacent,

HUMBLY SHEWETH,

That your Petitioners are desirous of representing to your Honourable House certain hardships to which the authors of mechanical and chemical inventions and discoveries are exclusively subjected by the existing laws, and the serious injury which is occasioned thereby to the arts, manufactures, trade, and revenue of the country.

That while the author of every new production in literature, new engraving, and new musical composition, has a right, by law, to the exclusive copyright thereof, for the space of twenty-eight years certain, and for as much longer a period as he may be in life after the lapse of the said twenty-eight years; the author of every new instrument, or machine, or chemical process, is only allowed the exclusive privilege of manufacturing or using the same for one half of twenty-eight years,—and that merely as a matter of royal grace and favour.

That while writers, engravers, and musical composers, are required to pay for the enrolment of their respective copyrights at Stationers' Hall, no more than *two shillings;* the inventor or discoverer of any new instrument, machine, or chemical process, cannot obtain letters patent from the Crown, for the exclusive privilege of manufacturing or using the same, for even the short period of fourteen years, for a less sum than upwards of *three hundred pounds.*

That the omission to enrol the copyright of any book, engraving, or piece of music, at Stationers' Hall, is not held to affect, in any manner, the validity of such copyright, but only subjects the person making default to certain inconsiderable penalties; whereas, in the event of any newly-invented instrument, machine, or process, being made public, whether designedly or accidentally, before an exclusive right to it for fourteen years has been secured by letters patent, the same becomes at once common property, and is lost to the inventor for ever. (C.)

That the registry of the copyright of a book, an engraving, or piece of music, takes place *instantly* on the demand of the proprietor, or person claiming to be so, without any preliminary inquiry being instituted into the originality or worth of the said book, engraving, or piece of music, or into the claimant's title to the authorship thereof; but that before letters patent can be obtained for any new instrument, machine, or chemical process, the inventor or discoverer has to submit the question of its originality, and his right to the exclusive

benefit of manufacturing or using the same, to a tedious examination by the officers of the Crown, at the risk of the whole particulars of such invention or discovery being in the meanwhile divulged to the world, and all claim to a patent thereby defeated. (D.)

That although letters patent for new inventions and discoveries are only obtained after a professed investigation of their merits by the officers of the Crown, no more security is gained by such investigation than the proprietors of new books, engravings, and music, obtain, without any thing of the kind; it being still required of the patentee of every new invention or discovery, that he shall bring proof of the originality of the same, in any action at law which he may institute for the infringement thereof. (A.)

That your Petitioners humbly conceive there is no ground for the many unfavourable distinctions which are thus made between the productions of men of letters and artists, and those of the mechanic and manufacturer; but that, on the contrary, all who, by the exercise of their genius, make any new addition to the knowledge, wealth, and resources of the country, are equally entitled to encouragement and protection. (B.)

That the peculiar restrictions and extraordinary expense to which mechanical and chemical inventors are subjected, by the existing state of the law, has the effect not only of excluding nearly all who are in humble circumstances from securing to themselves the fruits of their own ingenuity and toil, but of deterring even the wealthiest from prosecuting useful designs to a beneficial conclusion. (D.)

That the expense of all patents is the same, however much they may differ in value; and that it frequently occurs, that instruments and machines are invented, which are calculated to assist and promote, to a great extent, the manufactures of the country, but from being either of simple construction and small cost, or required by few hands, will not indemnify the inventor for the enormous cost of securing a right to them by patent, and are therefore neglected, or altogether kept secret. (D.)

That it is a case also of frequent occurrence, that a man spends all he is worth to obtain a patent for an important invention, and is then unable, for want of means, to turn it to any account, either for his own benefit or for that of the public. (D.)

That, in proportion to the trouble and expense to which patentees are subjected, the price of the articles they supply is necessarily enhanced to the community.

That, in most other countries—in the United States, in France, in the Netherlands, and even in Prussia and Austria—the greatest facilities are given to the taking out of patents, and the expense of them but small; tempted by which advantages, English artizans and engineers are daily induced to transfer their genius and skill to a foreign soil.

That, in every point of view, both as regards inventors and the public, the present system of granting patents appears to your Petitioners unjust, inexpedient, and injurious; discouraging and oppressing the inventive genius of the people; and, in so doing, fettering and obstructing one of the most fruitful sources of their prosperity.

That the fees payable on letters patent, and for the sake of which alone the rights of inventors and the interests of the arts and sciences appear to be endangered and sacrificed, do not, as your Petitioners are informed, exceed, on an average, ten thousand pounds per annum; while the national evils resulting from the system are beyond calculation.

That, of these fees, but an extremely small portion is of the nature of public revenue—the bulk of them going into the pockets of the officers of the Crown; and that it appears to your Petitioners, any loss which the revenue might sustain, through their abolition, would be ten thousand times more than compensated by the great increase of valuable inventions, which would be the consequence of placing them on

the same favourable footing with literary productions, and the consequent benefits which would be conferred on our arts and manufactures.

May it therefore please your Honourable House to take the complaints of your Petitioners into your consideration, and to grant such relief in the premises as in the wisdom of your Honourable House shall seem meet.

And your Petitioners shall ever pray, &c. &c.

HEATING BY STEAM.

Sir,—Having lately set up a steam-boiler for cooking, I think it will be possible to warm an adjoining room with steam heat; but not having seen any thing of the kind, I am at a loss to know how to proceed. The best plan I have been able to hit upon would be, to take the fire-grate out of the room, make up the bottom of the chimney, and place a large metal vase in the place now occupied by the fire-grate; the steam being conveyed into the vase to heat the room. The vase would require a pipe and a stop-cock to let out the condensed water. I will thank any of your correspondents to inform me whether the above plan be likely to succeed or not; and if not likely, what better plan they would recommend.

I am, Sir,
Your obedient Servant,
J. O. R.

VARNISH, OR COATING, FOR CANVAS, WANTED.

Sir,—I am induced to try the medium of the Mechanics' Magazine, in the hope of obtaining from some one of its numerous contributors the best mode of making a varnish, or coating, for light canvas, combining the following qualities—viz. lightness, durability, imperviousness to (at least a moderate shower of) rain, pliability, and cheapness; the last most indispensable, because the object is to introduce the use of it among a class of people whose means are generally so small that they are obliged to draw beforehand upon their employers. The insertion of this would particularly oblige

A CONSTANT READER.

June 25, 1827.

P. S. GLASS STOPPERS.—I would suggest another mode of getting glass stoppers out of bottles—viz. placing the bottle in a pan of cold water, and the whole upon the fire, provided what may happen to be in the bottle be not liable to serious injury from heat. The air inside will thus become gradually expanded, and the stopper driven out. It will be proper to attach a piece of cloth loose over the stopper to the neck, to prevent its flying out so as to do mischief.

A LUMINOUS BOTTLE.

Sir,—The following is a method of preparing a luminous bottle, which will give sufficient light during the night to admit of the hour being easily told on the dial of a watch. A phial of clear white glass, of a long form, must be chosen, and some fine olive-oil heated to ebullition in another vessel: a piece of phosphorus, of the size of a pea, must be put into the phial, and the boiling oil carefully poured over it, till the phial is one-third filled. The phial must then be carefully corked, and when it is to be used, it must be unstopped, to admit the external air, and closed again. The empty space of the phial will then appear luminous, and will give as much light as a dull ordinary lamp. Each time the light disappears, on removing the stopper it will instantly reappear. In cold weather the bottle must be warmed in the hands before the stopper is removed. A phial prepared in this way may be used every night for six months with success.

I am, Sir,
Your's obediently,
JAMES COX.

June 5, 1827.

MR. DOWLING'S LECTURES AT THE LONDON MECHANICS' INSTITUTION.

Sir,—In the short notice taken in your work of Mr. Dowling's Lectures on Arithmetic, delivered at the Mechanics' Institution, your Reporter says, that "the unequivocal signs which many of those present did not take pains to suppress, must have convinced the worthy gentleman of their opinion as to the merits of his lectures." Now, Sir, this is a gross misrepresentation of the fact; for whatever may have been the general opinion that circulated in the minds of the respectable audience, there was not the *least* sign of disapprobation during the delivery. It is granted, that at the conclusion the approbation was but faintly expressed. As a candid and honest chronicler, I hope you will insert this letter, on account of the feelings of Mr. D., and to save your respectable publication from being the channel of misrepresentation to the public.

I am, Sir,
A CONSTANT READER.

REPLY TO H. O.

On the alleged Error in Darley's Algebra, and new Arithmetical Question.

Sir,—If the celebrated mathematicians, Emerson and Euler, differed in their opinions regarding the true product of $\surd(-a)$ and $\surd(-b)$, the former asserting it to be $\surd(-a\,b)$, and the latter $\surd(a\,b)$; what may be said, then, of the opinion of so humble an individual as Felix Ford. However, one consolation he peculiarly feels, that not a tittle of his operation was found incorrect, or performed on erroneous principles, notwithstanding the exultation of Henry O—y on the subject. How àpropos are the lines of Horace on this occasion?

"Quid dignum tanto feret hic promissor hiatu?
Parturient montes, nascetur ridiculus mus."

The following is the 28th question of "Bonnycastle's Arithmetical Recreations," at the end of his excellent "Scholar's Guide to Arithmetic," last edition, somewhat altered for the sake of variety.

"A dishonest butler stole from his master's cellar a quart of wine, from a particular cask, then full, holding 42 gallons, and replenished the cask immediately with water. The next day he took another draught, of as much wine and water together, as, the day before, he did of wine, namely, a quart, and immediately replenished the cask with water; and thus he daily proceeded, till, at length, after a certain number of days he had been guilty of this malpractice, he was discovered; and then the quantity of pure wine remaining in the cask was ascertained to be exactly 23·53681 gallons. Now, it is required to find how many days this faithless servant had recourse, so basely, to his masters' cask?

I am, Sir,
Your's to serve,
FELIX FORD.

NOTICES TO CORRESPONDENTS.

Answers to the Geometrical Problem, No. 194; and to the Arabian Arithmetical Case, No. 205; in our next.

K. C.'s communications are intended for insertion, though delayed for a reason which will be afterwards explained.

W. G. received, and will be inserted shortly.

Communications received from F.—A Working Bee—Mr. Woolgar—Tim Bobbin—Sn. Ottar—J. L.—T. S. S.—, G. E.—Edinensis—J. M. S.—Ovolo.

ERRATA.—In Mr. Utting's Paper, Vol. VIII., p. 30, column 1, eleven lines from the bottom, for "distance from the sun," read "distance of the *earth* from the sun." Column 2, at the end of the third line, add—"provided the elongations of the satellites were correctly ascertained."

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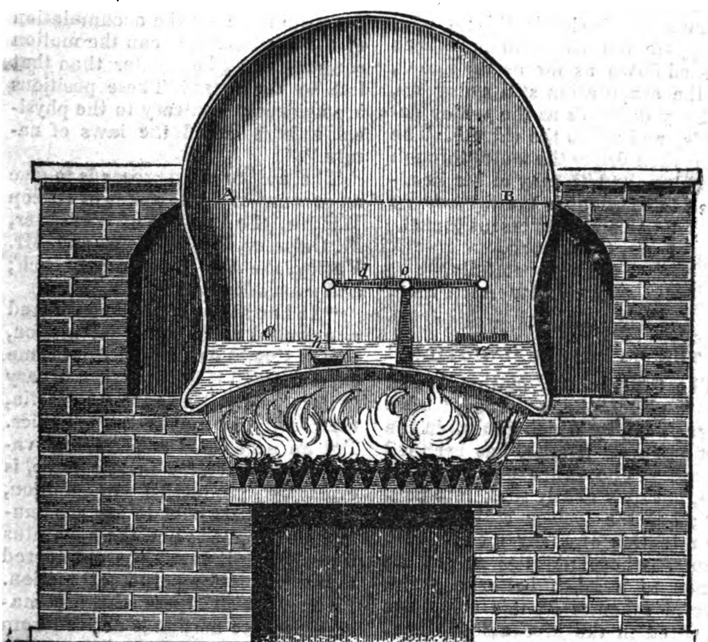
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 209.] SATURDAY, AUGUST 25, 1827. [Price 3d.

"The miser's gold—the painted cloud
Of titles, that make vain men proud—
The courtier's pomp, or glorious scar
Got by a soldier in the war,—
Can hold no weight with his brave mind,
That studies to preserve mankind."

SIR W. DAVENANT.

SAFETY APPENDAGE TO HIGH-PRESSURE STEAM-ENGINES.



Manchester, June 30, 1827.

SIR,—I have often observed that a great number of your pages are devoted to the subject of steam-engines; and as the safety of them is a point of vital importance, I must beg your insertion of the following simple addition to high-pressure boilers, which (though by no means a new invention) seems to have been only partially known or applied.

Many of the accidents which have happened from the explosion of high-pressure steam-boilers, have been frequently occasioned by want of proper attention on the part of the engineer to the forcing-pump, which supplies the boiler with water.

It is obvious, that if the pump should get out of order, and cease forcing into the boiler the regular supply of water, the production of steam must increase in rapidity in proportion as the quantity of water diminishes; so that in a short time the steam, so quickly generated, will attain a most dangerous degree of expansibility. To prevent this, is the object of the contrivance represented in the prefixed engraving, which exhibits a cross section of the boiler, fire-place, &c.

A B is the regular water-line.

d a small arm, or lever, moveable at the centre *o*.

c c a float or buoy.

h h a valve, seated in the bottom of the boiler.

The action is simply this:—

Suppose the water to have been lessened down as far as the line C, and the evaporation still going on, the buoy descends as the water descends, and raises the valve *h*. The steam then drives the water through the valve, and it may either be allowed to extinguish the fire, or be conveyed to any convenient tunnel.

I am, Gentlemen,

Your's respectfully,

ANDREW AIRPUMP.

ON THE "PERPETUAL MOTION."

The "perpetual motion," and the "philosopher's stone," are *ignes fatui*, by which genius, in the past and present ages, has been led astray. The latter pursuit, it is true, has now nearly sunk into neglect; but the former still engages the attention of many a clever mechanic, whose abilities might be turned to a much better account. Several schemes of this sort have appeared in the Mechanics' Magazine, one of them very recently (Vol. VII. p. 393). In the hope of discouraging so useless a pursuit, I beg to call the attention of the readers of the Mech. Mag. to an article by the late W. Nicholson, in the first volume of his Journal, quarto series. As the work may not be accessible to many readers, and as the writer's qualifications for handling the subject are not likely to be disputed, I shall take the liberty of making a few extracts.

"It has always been easy to show the fallacy of schemes for perpetual motion in the particular instances; but I have met with no clear enunciation of this project so general as to include every possible scheme, and evince its own absurdity. The difficulty of performing this, seems to arise from a want of direct and concise demonstrations of the fundamental principle of the lever, and of the equal pressure of fluids in all directions. What, in universal terms, is the thing proposed to be done? Is it to cause a body, or system of bodies, to act in such a manner that the re-action shall be greater than the action itself, and by that means generate force by the accumulation of the surplus? Or, can the motion communicated be greater than that lost by the agent? These positions are evidently contrary to the physical axioms called the laws of nature."

The author then proceeds to give an account of the schemes of Bishop Wilkins, the Marquis of Worcester, M. Orfyreus, Dr. Shiviers, and Mr. Varley, showing the fallacy of each; and concludes thus:

"It has always been considered as essential to a perpetual motion, that it should be derived from some energy which is not supposed to vary in its intensity. Such are the inertia, the gravity, or magnetism of bodies. For an occasional or periodical variation of intensity in any force, is evidently productive of motion, which requires only to be accumulated or applied; and the apparatus for applying it cannot be considered as a machine for perpetual motion. Neither, in strictness, can any machine, whose motion is derived from the motion or rotation of the earth, and the consequent change of seasons and rotation of events, be so considered, because it does not generate, but only communicates. The perpetual flow of rivers; the vicissitudes of the tides; the constant, periodical, or variable winds; the expansions and contractions of air, mercury, or other fluids, by daily or other changes of temperature; the

differences of expansion in metals by the same change; the rise and fall of the mercury in the barometer; the hygrometric changes in the remains of organized beings; and every other mutation which continually happens around us; may be applied to give motion to mills, clocks, and other engines, which may be contrived to endure as long as the apparatus retains its figure."

With regard to Mr. Else's scheme, nothing seems more easy than to point out its fallacy. The springs against which the pendulum-ball strikes, being supposed of equal intensity, it is perfectly clear that whatever impulse is given by the one will be destroyed by the other; and that such effect must equally take place, whether the tension of the spring be produced by direct impact, or by the circuitous method of levers, cords, and pulleys.

I am, Sir, your's, &c.
J. W. WOOLGAR.

PILE DRIVING.

Our ingenious correspondent, Mr. J. E. Barrat, has represented to us, that previous to the insertion, in June last, of Mr. Mackinnon's accurate solution of the question on this subject, he had forwarded to us one quite as accurate, but to which we omitted to give a place. "Mr. Mackinnon's answer," he says, "being 215,22 cwt. and mine 215·220816 cwt.; which varies from his only in consequence of my extending the decimal process a little farther; and both were deduced from the same well-known law of mechanics, viz. that $V = 2\sqrt{59}$, where S denotes the perpendicular fall, and $9 = 16\frac{1}{12}$ feet." We have a perfect recollection of receiving a solution of this problem from Mr. B., and also of subsequently looking for it in vain among our papers, when desirous of comparing it with the others we had received. It was appended, we believe, to a longer communication from Mr. B. on another subject, inserted Vol. VII. page 106; and was lost to us, we suspect, in consequence of the sheet, which contained both articles, having been inadvertently thrown aside after the insertion of the first. The conclusion of Mr. B's present letter, it is, under these circumstances, but justice to him to insert; nor on this account alone is it worthy of a place; for Mr. B. has embraced the opportunity of adding a most valuable table, which was not included in his original communication.

Mr. Barrat to the Editor.

"I will again state the rule and solution, which are precisely the same in substance and result, as I sent you before; and, in addition to them, a Table, which I have since constructed on the subject. The rule is stated, and applied, for the solution of the present question, in such a manner, that the carpenter, or any one who can extract the square-root, will find no difficulty in applying it to any similar question that may occur on the subject. At first sight, it may appear that I differed from Mr. M. in my former statement, respecting the ram falling over an inclined plane; but it will be found that the principle in both assertions is the same; for Mr. M. considered the plane was of such a length that its perpendicular height was 20 feet; and I think, on reviewing the question, that he hit on the carpenter's meaning: but I concluded at the time, that the *plane* was to be 20 feet in *length*, with a declination of 11 feet, and calculated the perpendicular height accordingly. Perhaps it may not be improper to allude to the question in that state, and to tell the carpenter, that when the perpendicular height is not given, but the length of plane and declination is known, the height must first be found by the nature of a right-angled triangle, thus; $\sqrt{\text{plane}^2 - \text{decl.}^2} =$ perpendicular height; and the calculation must be conducted as though it had fallen perpendicularly from that same height: the only difference of its passing over an inclined plane, or falling the same height perpendicularly, is, as Mr. M. observes, occasioned by friction, which of course increases with the declination.

Rule.—Multiply the perpendicular height by 16.1-12 feet, take the square root of the product, and multiply it

by 2, which gives the velocity acquired; this multiplied by the weight of the ram, will give the momentum or force required.*

Example.—With what force will a ram of 6 cwt. fall, on being disengaged 20 feet above the pile?

```
     20 feet, the perpendicular height
     16 1/12
     ---------
     321·666666 (17·935
     1                  2
     --             ------
27)221          35·870, the velocity acquired at the end of the descent.
   189               6
   ----         ------  cwt. qr. lb.
349)3266        215·22 cwt. = 215  0 24, the power or force required.
    3141
    ----
3583)12566
     10749
     -----
35865)181766
      179325
      ------
        2441
```

The following Table is constructed by the same method:—

Weight of Ram.	Fall of 5 Feet.	10 Feet.	15 Feet.	20 Feet.	25 Feet.	30 Feet.	35 Feet.	40 Feet.	45 Feet.	50 Feet.
Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1	17·934	25·364	31·064	35·87	40·104	43·93	47·45	50·728	53·804	56·714
2	35·868	50·728	62·128	71·74	80·208	87·86	94·90	101·456	107·608	113·428
3	53·802	76·092	93·192	107·61	120·312	131·79	142·35	152·184	161·412	170·142
4	71·736	101·456	124·256	143·48	160·416	175·72	189·80	202·912	215·216	226·856
5	89·67	126·82	155·32	179·35	200·52	219·65	237·25	253·64	269·02	283·57
6	107·604	152·184	186·384	215·22	240·624	263·58	284·7	304·368	322·824	340·284
7	125·538	177·548	217·448	251·09	280·728	307·51	332·15	355·096	376·628	396·998
8	143·472	202·912	248·512	286·96	320·832	351·44	379·6	405·824	430·432	453·712
9	161·406	228·276	279·576	322·83	360·936	395·37	427·05	456·552	484·236	510·426
10	179·34	253·64	310·64	358·7	401·04	439·3	474·5	507·28	538·04	567·14

I am, Sir,
Your's with every respect,

Whitehaven. J. E. BARRAT.

* Dem. It is found by experiments, that a body will fall through $16\frac{1}{12}$ feet in the first second, and that its velocity at the end of 1st sec. is $= \frac{1}{12} \times 2$; also, that the velocities are as the times, and the spaces as the square of the times: hence, the following proportions, where g denotes $16\frac{1}{12}$, and 29 the velocity at the end of the 1st sec.

1st. As $1'' : t'' :: 2g :: 2gt = v$, the velocity acquired in t''.

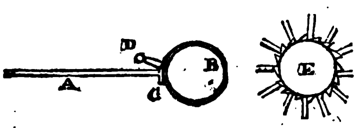
2nd. As $1^2 : t^2 :: g : gt^2 = s$, the space passed over in t''.

From the 2nd $s = gt^2 \therefore t = \sqrt{\frac{s}{g}}$; substitute this for the value of t in the first, and $v = 2gt'' = 2g \times \sqrt{\frac{s}{g}} = 2\sqrt{sg}$; that is, the velocity is equal to twice the square root of the product of the space, multiplied by $16\frac{1}{12}$ feet: hence the above rule.

P. S. I think there is an error in Mr. W. Lake's solution to the reservoir case, inserted in your supplementary part of January, p. 556, Vol. VII. It originated in the proportion $h : x :: a - d : JK - d$, which should have been $h : x :: a - d : a - IK$; consequently his answer of 7.7852 feet is wrong, and should have been 6.6595 feet.

WAGGONERS' ASSISTANT.

Sir,—Allow me to describe to your readers a mechanical agent, which has been found to be very useful in a hilly country. It consists of the adaptation, to a cart or waggon, of a pair of treadles, having at the end farthest from the man an iron hoop, which passes round the nave of the wheel, on which nave is a ratchet for each treadle, or one ratchet lying between the two treadles; and in the treadle is a click to fall into the teeth of the ratchet, which click may, by a pin, be raised when not wanted, and thus prevent the noise arising from its constant action.



A represents the treadles; B the hoop; C the click, made of bent iron, about one inch square, and kept in its place by the weight of the knob D, instead of a spring; E a section of a nave, with the ratchet on it.

This is no new method, but is useful in a hilly country. A seat for the man, and a rail to hold by, may be put on the waggon; the ends of the treadles under the man's feet are attached to each other by a cord passing over a pulley.

The expense of this addition would be trifling, and it would much relieve the horses up a steep hill, where their pace is slow, without fatiguing the man, who could easily step down if the horses wanted any management.

I am, Sir,
Your obedient Servant,
A. W.

INCREASE OF HUMAN FOOD.

We copy the following paper from a recent number of the *Caledonian Mercury*, and earnestly hope that its insertion in our pages may effectually promote the patriotic purpose of its benevolent author. The facts which it contains speak for themselves; so much so, as to make it apparently but a matter of choice, whether the people shall double their means of subsistence or not.—*Ed. Mech. Mag.*

Every country which depends chiefly on potatoes for food, must be frequently exposed to scarcity, because the surplus of one year's crop cannot be preserved to supply the deficiency of another, as in the case of grain. The extreme poverty of our people has compelled them to subsist almost entirely on this root for several years, and it has therefore become an object of the highest importance to discover a remedy for the above defect. Since the famine which prevailed in Ireland in the year 1821, I have paid great attention to this subject, and I found that this purpose might be accomplished in various ways; but the conversion of potatoes into flour, I consider far superior in utility to any other means. By many experiments, I found that potatoes, of good quality, will afford about a fourth part of their weight of this flour, if carefully prepared, and of the same degree of dryness with common flour. Fourcroy says it yields a fifth; some chemists say less, and others say more: and it is notorious, that a large portion of what is sold in our shops under the name of arrow-root is actually this flour manufactured at home. Accum stated this many years ago, and medical men are quite aware of the fact; nor is the purchaser injured by this deception,

the one being, in all respects, precisely the same with the other, of which any body may satisfy himself by comparing them. I have very often known persons who had long been accustomed to the use of arrow-root in the West Indies, take the potato flour in its stead, without ever suspecting any difference; nor is there indeed any. The two roots are natives of the same country, and entirely of the same quality: they are also applied there to the same purpose; arrow-root being used for starch, as well as the potato flour. This flour is admirably adapted for commercial purposes, from its great value in small bulk, and it may may be kept without damage for a great length of time. I happen to have known it preserved for eight years without any change whatever. This article has long been used by several respectable families in the Highlands of Scotland, as a substitute for wheaten flour, on a small scale, for curiosity; though it has never been turned to any public advantage as food, so far as I know. I have myself, however, used it for a considerable time in my own house, in large quantity, with great satisfaction, for puddings, pancakes, and all sorts of pastry. It is incomparably good: boiled in milk, or water coloured with milk, it makes excellent food; and mixed with a small portion of common flour, with eggs, or even with mashed potatoes, it makes the finest loaf bread; and improvements in cooking it will no doubt be daily made. In short, it is in all respects superior to wheaten flour, and equal to arrow-root. The enormous quantity of potatoes which the stomach receives, and which the system requires for nourishment, when it is the sole food, cannot fail to injure that organ, and diseases of that class have therefore become very frequent of late years, to the unspeakable distress of the lower orders. On weighing the measure of potatoes usually allotted for a labourer's meal, I found it amounted to six pounds, and from that I procured a pound and a half of flour, which afforded eight breakfasts for my own use, each consisting of two table spoonsful of the flour boiled in a pint of milk. This very interesting fact may give us some idea of the importance of this subject. Here we have many wholesome, delicious, nourishing, nay luxurious meals, from one very bas one; in consequence of the very familiar and easy process which the material had undergone, the worst of all human food is converted into the very best. The average produce of an acre of land under potatoes over the United Kingdom, cultivated by the spade, may be calculated at from 150 to 200 barrels, or from 14 to 18 tons,* which will yield from three to four and a half tons of flour, or from 50 to 70 bolls of 140lbs. each. Now, our best land under wheat will not average above six or eight bolls an acre. The return of flour from wheat is very various. (Arthur Young says, that the average produce of England is about 22 bushels an acre.) When we add to this the superior quality of this flour, we have here an advantage almost too great for the mind to conceive: immense as the advantage is, however, it is unquestionably true, as may be easily proved by the infallible test of experiment, which all, even the poorest, can easily make, and to which they are earnestly entreated to have recourse. The annual expense of supporting the poor of England and Wales cannot be short of eight millions, including every shape in which charity is bestowed. Under this system, let an acre of land and the milk of a cow be assigned to every four poor families; with these and a few hens, they may live comfortably; to breakfast and supper they may have this flour boiled in milk; and to dinner, by the addition of eggs, they may have pudding or pancakes, while they themselves may cultivate the ground. This is stated as one of the innumerable blessings which may flow from this improvement. If the yearly produce of the United Kingdom be worth several hundred millions, as political calculators assert, what must be the value of that discovery which increases that produce many-fold? By the due cultivation of this system, in the short space of two years, Great Britain and Ireland, instead of depending on other countries for food, may supply the greater part of Europe; and even China would maintain many times its present population. According to the usual price of potatoes, the boll of this flour will cost about seven shillings, or fourteen shillings the sack; the pound will cost about a halfpenny, and half a pound is about the average consumption of a family. Now, this is the very same article which the rich and luxurious at present enjoy, and actually consume in large quantity, at the exorbitant price of 2*s*. the pound, or £28 the sack, under the foreign name of arrow-root; and we have lately seen

* In 1800, an acre of land in Fifeshire produced 80 bolls of potatoes, or 320 barrels, for which a premium was given by the Highland Society.

it at double that price;* while all this benefit is obtained without any expense whatever. Perhaps there is no process more universally known than the manufacture of this flour under the appellation of potato-starch. By means of a barrel lined with sheet-iron grating, placed on an axle horizontally, like a butter churn, the women and children of a family may prepare any quantity of this flour; and this barrel will supply fifty or sixty families, at an expense of less than a shilling each. The pulpy mass may be filtered through the milk strainer, or a coarse cloth, diluting it plentifully with soft water; it may be dried on linen or on boards in the sun's rays, or in an oven over a slow fire, stirring it frequently.† Corn must be threshed, fanned, kiln-dried, ground, and sifted—all of them laborious, tedious, and some of them very expensive operations—while potato flour may be prepared without any expense; and it may be used as food in the course of three or four hours after the root is dug from the ground, though, for preservation, it must be rendered perfectly dry. In course of time, mills will no doubt be constructed for grinding, or mashing, and filtering it, and proper kilns for drying it. The intimate knowledge which our people already have of this article, under a different name, and for another use, ought to favour the rapid progress of this discovery. Too many persons, however, entertain a silly, contemptible prejudice against improving whatever is already in some respects familiar to them, forgetting that every thing was once new. "Can any thing good come from Galilee?" is a sentiment as prevalent at this day as it was 1800 years ago. The health and comfort of the lower classes were my great objects in cultivating this subject; but it cannot be denied that these foolish prejudices prevail most powerfully among them. It must, however, be adopted, and that very speedily. The vast increase of produce, its excellent quality, the very general use of arrow-root, and their own late severe sufferings and privations, will render them anxious to procure relief; the numerous public institutions which now exist for instructing the people in useful knowledge, will disseminate it among them; and a generous and patriotic periodical press will be a most powerful, and, I am convinced, a most willing agent. It particularly belongs to the clergy, of all denominations and of all parties, to exert their influence in this work of benevolence; and it is to be hoped that no selfish motives will diminish their zeal in an occupation so peculiarly becoming their sacred office. The managers of hospitals and all public works will countenance it. Schoolmasters will also have much in their power, in recommending this most important piece of domestic economy by example and precept. Indeed, every man who wishes well to his country or his species, will support it. The poorest mechanics or labourers may now live with a degree of comfort hitherto unknown, and the enjoyment of it depends entirely on themselves. I am aware that a prohibition exists against using potato-starch for linen, with the very ineffectual purpose of favouring the duty on wheaten starch, which can return but a very trifling amount of revenue. This prohibition, however, could not have been intended to extend to the making of them into flour for food,—a thing which was then totally unknown. The legislature could never have contemplated so cruel, unjust, and oppressive a measure,* and one which could not have been put in execution without placing an excise officer in every house; nor is it under the present liberal and enlightened Government, that such a prohibition is likely to be enforced, even if it had existed. Potatoes will grow in every soil and in every climate, and the same land will produce undiminished crops of them successively for any length of time. It is not the surplus only of the crop, that may now be procured by converting it into flour; but even the whole may be thus rendered, except the seed. At a distance from market, a very large portion of this root was almost entirely thrown away, when very abundant; but this will be no longer the case, as they will be made into a delicious and valuable food. If Henry the Great prayed that he might see every peasant in his kingdom have a fowl to dinner on Sundays, how gratifying must it be to our benevolent and beloved Sovereign to reflect that the poorest man in his vast empire

* Eighty bolls of this flour, being the produce of one acre, if sold at 2*s.* the pound as arrow-root, would amount to 1120*l.*

† The refuse which remains on the filter will make delicious puddings, if prepared in the same manner with rice; and the water is a powerful detergent.

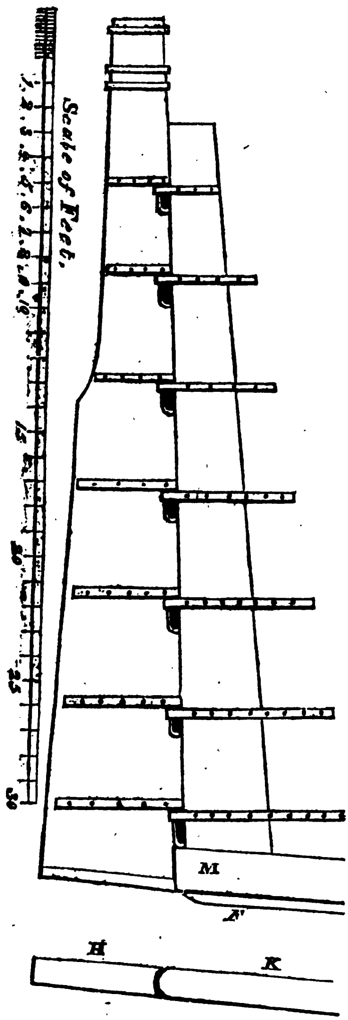
* I am happy to state, that one of the highest and most intelligent officers of the revenue in Scotland agrees entirely in this opinion.

may now enjoy what is better than a fowl every day in the week.

MEDICUS.

Note.—It may perhaps be alleged that this plan had been suggested formerly; but should that be true, it would be only an argument in its favour.

MR. WEEKES'S IMPROVED RUDDER.



Sir,—As your valuable work is remarkable for useful communications on shipping, I have thought that, through its medium, an improved rudder, which was adopted by the Navy Board, on the suggestion of Mr. Weekes, assistant master shipwright of Chatham-yard, may meet the eye of our merchant-ship-builders; and that, seeing its advantages, they may avail themselves of it, and thereby prevent many serious accidents;—if so, I shall be happy in adding something to the benefit of the Mechanics' Magazine, in return for the many advantages I have derived from it.

It is well known to mariners, and to most persons who travel on the water, that a rope will frequently get between the rudder and the sternpost, from which it is impossible to disengage it without cutting the rope; and that, even then, this circumstance often impedes the action of the rudder in such a manner as to render it useless; thereby leaving the vessel without guidance, at the mercy of the winds and waves. This is particularly the case in rivers and narrow harbours, either in boats or ships. To prevent this, Mr. Weekes suggested an ingenious contrivance, by which the lower end of the rudder revolves round a cylindrical termination of the keel, the heel of the rudder being also cylindrical for that purpose, as shown by the prefixed sketch.

M is the main keel; F the false one; H the heel of the rudder; K the upper side of the main keel. The post and rudder above the keel remain precisely as before, and bearded in the usual way.

By this means, it is evident, no rope can get between the rudder and post, and entangle itself; as it must gradually slide over and be disengaged.

After the plan was matured, and general orders were issued for its adoption in the Royal Navy, in April, 1819, a Mr. Hookey, who was also a master shipwright's assistant at one of the King's Yards,* brought forward, in opposition to the claim of originality on the part of Mr. Weekes, a mode for effecting the

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* Now, we believe, timber receiver at Deptford Dock-yard.—EDIT.

same object in ships and vessels, which had been formerly applied by him to boats. But, having myself had the curiosity to inquire respecting this old mode, I must beg to express my surprise that an attempt should be made to confound it with that of Mr. Weekes. In Mr. Hookey's plan, the sternpost is hollowed out from top to bottom; whereas, in Mr. Weekes's, it is only the heel of the rudder that is grooved, which leaves the fastening of the pintles and braces as formerly—does not weaken the sternpost—and renders it easily applicable to old or new ships. It is extremely doubtful, too, whether Mr. H.'s plan could be rendered serviceable in ships, even if a great waste of strength and materials were allowed.

It is true, that the interior revolution of a cylinder in that of an exterior one, is like the application of the same thing by Mr. Snodgrass for the heads of rudders, used in the two cases under discussion, but with very different effect, and varying in important circumstances, as just mentioned. That Mr. Hookey deserves some praise for the limited extent to which his mode has been applied in boats, I am ready to admit: but I would put it to the candour of all men, and of Mr. Hookey himself, whether it be not fair, that, as every gradual improvement in steam engines, or other machines, gives the title of invention and exclusive right to the last improved alteration; so Mr. Weekes may claim that merit in his rudder—especially as Mr. Hookey's mode was unknown, and had not been made publicly beneficial.

I am, Sir,
Your humble Servant,
A Friend to the Mechanics' Magazine.

HOW TO PREVENT WASPS FROM ENTERING BEE-HIVES.

At this season bees are most attacked by wasps, which very often destroy the whole hive. To prevent their entering the hive, procure a piece of wood (which must be white deal) about from four to six inches long, and of the same thickness and width as will go into the mouth of your bee-hives. At the underside of this piece of wood, make a groove about half an inch in diameter, or as large as three or four bees can go in or out at once; then, when a wasp makes an effort to enter, the bees will have a better chance of defending themselves; for if it goes past one bee, there will be another to engage it. Without this tube the wasp would boldly enter, and creep in between the combs, before the bees would have any suspicion of it; and so carry off the fruits of their labours. This tube may be thrust in about three inches, or as far as you can for combs, and may remain in all the winter, which will keep out the cold winds; and in spring, when the bees begin to work, they may be taken out entirely. An early insertion in your useful Magazine will much oblige your obedient servant,

A WORKING BEE.
Doncaster, Aug. 10, 1827.

SERIES OF PHILOSOPHICAL EXPERIMENTS, AND ILLUSTRATIONS OF APPARATUS, ON SIMPLE PRINCIPLES.

BY MR. W. H. WEEKES.

(*Continued from page* 70.)

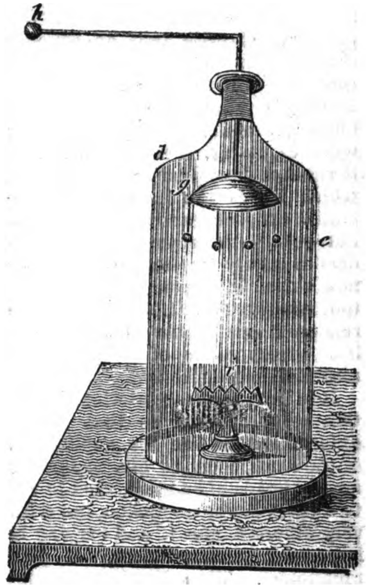
NO. IX.

Aurora Borealis.

The singular and strikingly beautiful appearances presented by the Aurora Borealis, are among the phenomena which admit of satisfactory illustration, and a very happy imitation, by the agency of electricity. Cylinders, flasks, and tubes of glass of considerable length, when properly capped, rendered impervious to the entrance of air, and subsequently exhausted, as is familiar to electricians, on being presented to the prime conductor, are rendered beautifully luminous throughout their cavities, and present some approach to the phenomena of the aurora.

The Abbé Bertholon constructed an ingenious apparatus for this pur-

pose, consisting of two crescents of metal which were cut into angular projections corresponding with each other; the one attached to the top of an exhausted receiver, the other resting on the plate of the air pump, and through which he sent a continuous stream of electricity. A great increase of electric light is thus obtained in nearly an *equally diffused state* throughout the vacuum, and the experiment is doubtless attended with very pleasing effects. The beautiful *striæ* of light, and strongly defined luminous *radii*, which generally characterize the aurora borealis, are, however, still wanting to complete the illusion; nor, I am persuaded, can the perfect imitation of this resplendent phenomenon be obtained by the single use of *metallic points*, or the *continuous* transmission of electricity through the receiver. In the natural aurora, we observe the streams of light forming strongly defined pyramids or cones in the midst of a fainter luminous area, alternately appearing and vanishing in rapid succession; and these characteristics may be, with ease and certainty, accurately represented by employing the apparatus represented in the following engraving. *d e* represents a tall receiver, resting on the plate of the air pump; and through the neck of the glass passes a stout wire, bent at right angles, (rendered air-tight by a collar of leather,) and terminating at one extremity in a brass ball *h*, about an inch in diameter. To the other extremity of the wire, terminating within the receiver, is screwed one of those hemispherical bells commonly used in the experiment denominated the "electrical chimes," from the edge or circumference of which descend perpendicularly six fine sewing needles, terminating in small metallic knobs about the size of a large pea. Resting upon the plate of the air pump, rises to the height of about two inches the metallic stand *i*, the thin plate of which is shaped into the arc of a circle, having a deeply serrated edge, and is distant from the knobs of the bell *g* about ten or twelve inches. While an assistant is engaged in turning the winch of the electrical machine, let the knob



of the apparatus be gradually approached towards the large ball *e* of the conductor (represented in our last number), until the knob *h* of the bent wire is brought within an inch of the surface of the former. The electrical machine being in good order, and the receiver *d e*, resting upon the pump plate *f*, being now exhausted, a most beautiful and perfect imitation of the aurora will obtain, presenting those characteristic features of the natural phenomenon before described, and which may be constantly varied in intensity, by regulating the distance, and consequently the magnitude of the spark, between the bells *c h*; in the management of which, a few trials will ensure success. During the experiment, the light evolved within the receiver will be sufficient to enable a person of ordinary vision to distinguish common type without difficulty.

The principle upon which the insulated metallic hemisphere and its auxiliary apparatus are depen-

dent, in this experiment, is too obvious for me to offer any explanation to the electrician.

(*To be continued.*)

APPENDIX TO THE PAPERS ON THE SLIDING RULE.

Sir,—As the use of the rule is a very proper object of instruction in a Mechanics' Institution, it may not be amiss to describe a rule of large dimensions, now constructing for the use of a class. This instrument is of painted deal, 66 inches long, and 6 broad, with a slide of the common form in the middle. The line A is one of double radius, 40 inches long; the lines B and C on the slide are of treble radius, 60 inches long; and the line D is of single radius, 40 inches long, graduated from 0·4 to 4, and being continued thence to 10, makes the whole length 55·9 inches. Upon the upper part of the stock, in continuation of the line A, is a thin slip of mahogany 24 inches long, with a slit in the middle, by means of which and of two screws, it is attached to the stock, and is adjustable longitudinally thereon. On the feather-edge of this mahogany slip, and conterminous with its left extremity, is a single inverted line, of 20 inches. Thus the instrument, for two-thirds of its length, corresponds exactly with the common carpenter's rule; and by means of the other third, it is adapted to illustrate the variations of contraction exhibited by the double-slide rule, the engineer's rule, and the exciseman's rule.

I am, &c.
J. W. WOOLGAR.

Lewes, August, 1827.

MECHANICAL PARADOX.

August 11, 1827.

Mr. Editor,—The difficulty under which your correspondent, "Investigator," (Vol. VIII. p. 48,) seems to labour respecting the "mechanical paradox," may, I think, be solved in the following manner; which is, in fact, the solution of it given by Mr. Ferguson, the inventor of the machine:—

"If," says he, "two wheels, having an unequal number of teeth, work into each other, and the power be applied to the large one, it will move the small one the same way in comparison to the other; but if the power be applied to the small one, it will move the other the contrary way; but if two wheels, *having an equal number of teeth*, work into each other, and the power be applied to either of them, it will move the other *no way at all* in comparison with the other."

If, then, your correspondent views one wheel moving one way, the other the contrary way, and the other "no way at all" compared to another wheel at rest, he will still remain in a difficulty, which cannot be solved by any person; but if he compares them with the wheels to which he applies the power, he may then plainly perceive why one moves "no way at all."

S. W. N.

ONCE MORE—ORIGINALITY *v.* PLAGIARISM.

Paddington, Aug. 20*th*, 1827.

Sir,—Felix Ford seems rather inconsistent in proposing, in your last Number, Bonnycastle's question of "*The dishonest butler*," &c.; for when Clyde, in page 551, proposed a question of a similar nature, Felix Ford, in reply to it, said, "*Let us always have something* NEW *in your excellent Magazine, and nothing in the shape of plagiarism!!*"

Clyde's question ran thus: From a pipe of wine containing 110 gallons 10 gallons were drawn off, and the vessel replenished with 10 gallons of water; after which 10 gallons of the mixture were drawn off, and then 10 gallons of water were poured in: now, the process having been repeated *four* times, it is required to find how much wine remained in the vessel, supposing the two fluids to have been thoroughly mixed each time?

Now, as Bonnycastle's question proposed by Felix Ford, and the question proposed by Clyde, are of

the same nature, it is astonishing that it did not occur to Felix Ford that he had made the above observation on Clyde's question.

"Could we but see oursels as ithers see us,
It would frae mony a blun'er free us."
BURNS.

I am, Sir, your's, &c.
TAY.

A fair retort! but to all our correspondents we would say,—let us have the practice which Mr. Ford recommends, rather than that which, in this last instance, he has exemplified.—EDIT.

CURE FOR BROKEN SHINS.

Sir,—It may be useful to workmen to know that powdered charcoal, made into a paste with water, and applied to any sore place caused by the skin being rubbed off, will immediately allay the smart and remove the inflammation. I applied it with perfect success to a very bad broken skin, which was caused by slipping through a newly made floor, by which the skin of the shin was rubbed off from my instep nearly to my knee. The application of the charcoal made into a paste took off the pain and inflammation; and I was not laid up with it one hour, instead of being so, as I expected, for three months. I renewed the application morning and evening till the place was quite well, which it was in four or five days.

I am, Sir,
Your humble Servant,
S. OTTAR.

A METHOD FOR TAKING AN IMPRESSION FROM A COPPER-PLATE ON PARIS PLAISTER, WITH COLOURS, AS IN COMMON PRINTS.

Let the plate be filled with ink (made of the best ivory black, mixed with drying linseed oil, and ground very fine on a painter's stone) and the surface cleaned with the hand and whiting, as common copper-plate printing. Provide yourself with a board about half an inch thick, just the size of your plate; round the edge of this, wrap some stiff paper, raised half an inch above the surface on one side, and level on the other, in the form of a trough: into this put your plate, with the prepared side upwards; then mix your Paris plaister with water to a proper consistency, and pour it on the plate; then lifting up the trough, let it fall flat upon the table again, to drive the bubbles of air from the plate through the surface of the plaister, which, after you have repeated about 12 times, let it stand an hour. Afterwards take the plate out of the trough, and the plaister, now hardened, from the plate, and you will have a very neat impression on the plaister, fit to put in a frame, and by far preferable to the best prints.

W. HARDING.

FIRE EXTINGUISHING APPARATUS.

Sir,—Allow me to thank a "*Pedestrian*" (see page 73) for the friendly manner in which he noticed a communication of mine in No. 205; and also for the valuable information contained in his letter: at the same time I must beg leave to make a few observations thereon. He says, he thinks there are some objections to the plan of Mr. Buston; but, as he does not state what they are, I am unable to give him any further information, except that it has been tried, and never without success.

He thinks it would be advantageous to work the engine with clean water: but they are now so constructed, that any dirt that will pass through the drain, will not in any way hurt them; and dirty water is far more effectual in extinguishing fire than clean.

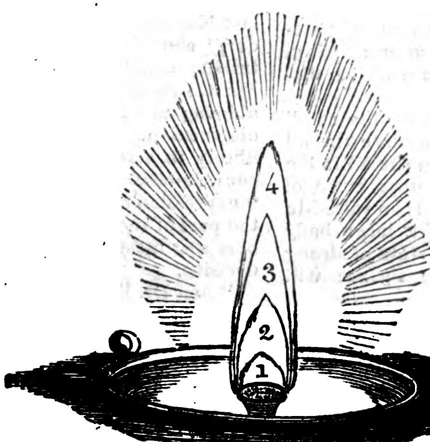
Posts, similar to those described by him, have long been erected throughout the metropolis by the New River Company, but not charged to the extent of those at Chelsea; nor do I think that the range of water-pipes is equal to the pressure (about 35 lbs. on the square inch). Fire-engines, to work from these cocks, must take up the stones to collect the water; for though *one*

engine could screw on a length of hose to convey the water into its cistern, yet, at a large fire, where several engines are at work, one of them must not engross the supply in this way. To render these highly-charged *fire-cocks* really serviceable, an experienced fireman should always be on the spot, well provided with hose, branches, and other needful apparatus; and if a systematic arrangement of this kind were universally adopted, the number of *bad* fires would be very materially reduced: but merely placing them in the street will be of little service, beyond furnishing the fire-engines with a good supply.

They have some fire-cocks in the Temple, superior to any thing *I have yet seen* of the kind; they are in the form of a square pedestal, of cast iron, the front of which lets down and forms a cistern, in which the water is received from the fire-cock, and from whence the engines can draw a supply by means of their section-pipes.

I remain, Sir, your's respectfully,
W. BADDELEY, JUN.
10, *George-yard, Lombard-street,*
Aug. 21, 1827.

THE GRADUATED NAUTILUS LAMP, OR NEW FLOATING LIGHT.



Sir,—I wish to call the attention of your readers to the consideration of the combustion of oil by means of a small glass tube; which is now commonly known by the name of the floating lamp.

One of these lamps, which I have before me, is contrived so that the flame may be raised or depressed; and it is accompanied by simple instruments for this purpose. It is one of the most complete I have yet seen, and is named "The Graduated Nautilus Lamp."

It is about two inches in diameter, and half an inch deep; and is set to float on the surface of the best sperm oil, contained in any small vessel of glass or porcelain—(a china saucer will do very well). In the centre there is a perpendicular glass tube, of extremely small bore, and open at both ends. On applying a light to the top of this, a flame is almost instantly produced, which may be raised several degrees, by dropping over the tube (with a pair of small tongs provided for the purpose), one or both of two small rings into a recess at the bottom of the lamp. All the trimming required, consists in removing, every morning, a certain carbonaceous or black crusty matter, which collects

round the orifice of the tube; to do which there is a small pricker, which accompanies the lamp.

Philosophical Explanation.

The following remarks are intended for the curious, who look beyond facts, and examine into causes. A little philosophy soon destroys any surprise excited by the oil burning without a combustible wick. If the surface of the oil, at the point of combustion, be minutely examined while the lamp is burning, it will be perceived to be in a state of ebullition; the small bubbles that arise are, in fact, the oil-gas, and it is by them that the flame is supported—flame being *never* produced except by the combustion of aeriform matter. If the top of the wick of a candle be minutely examined immediately after snuffing, the same phenomena will be distinctly visible.

In the nautilus lamp, the small glass tube serves to insulate the oil contained therein from the oil in the reservoir; and the temperature of so small a quantity is soon raised to the required heat: if a large body of oil be heated to a state of strong ebullition, the whole surface will equally inflame.

Let not the uninquiring eye of the "cui bono" character ridicule this explanation; ignorance laughs at what he thinks fastidious truth. "There was a grain of sand that lamented itself as the most unfortunate atom on the face of the earth; but, in process of time, it became an emerald, and shines the brightest gem in the diadem of Persia!" This encouraging precept was originally written, "became a diamond;" modern discoveries have proved that sand could never produce diamonds; but the production of an emerald from such a source is not impossible.

Your obedient Servant,

J. L.

MR. DOWLING'S LECTURES AT THE LONDON MECHANICS' INSTITUTION.

London, Aug. 20, 1827.

Sir,—As a Member of the London Mechanics' Institution, I have, from their first appearance, felt great pleasure in seeing reports of its public preceedings in your respectable journal; not only because they have been, and are, undeviatingly faithful in the statement of facts, but when any thing has occurred which the writer of them has conceived to require observation, the duty has been discharged with the utmost apparent candour and good feeling. Holding, as I do, this opinion of the merits of your chronicler; and feeling, also, that whatever of praise or censure may be occasionally applied to him, cannot fail of being, in some measure, identified with your Magazine; I am particularly desirous that the false charge of "gross misrepresentation," brought against him in the last Number by "A Constant Reader," should not pass without refutation; which, as I was present at Mr. Dowling's lectures, I am glad at being able to supply from my own observation. I therefore take the liberty to assert, without fear of a *conscientious* contradiction, that the "expression of disapprobation" on the part of the majority of the members *was* most "unequivocal" and decisive.

When Dr. Birkbeck (who was expected to lecture himself on the evening in question), upon entering the theatre, took possession of the president's chair, and Mr. Dowling advanced to the lecture-table, there was evidently a feeling of disappointment amongst the numerous members present; which disappointment increased as the lecturer proceeded, till, at last, it almost literally "groaned." I feel certain, that the presence of Dr. Birkbeck alone restrained a yet more open indication.

With the question of the merit or demerit of Mr. Dowling, or whether the members are entitled to express disapprobation (which, considering that the lectures were *gratuitous*, I much doubt), I have nothing to do, my object being to evidence the truth of your report; which having done, I beg to subscribe myself,

Sir,

Your obliged and faithful, &c.

AURUM.

P. S. On the second night of Mr. Dowling's lectures, the attendance of members was so thin, that, notwithstanding it was in the dog-days, the theatre was kept barely warm.

[We have received letters to the same effect from Q., and "A Member of the Committee."]

SOLUTIONS OF THE ARABIAN ARITHMETICAL CASE, (p. 30, Vol. VIII.)

BY PHILO-TRUTH.

Assuming that each of the loaves were of the same size—that each of the party ate the same quantity—that the whole of the 8 loaves were eaten—and that the pieces of money were of the same value; the sentence of Ali, the Arabian magistrate, will be found to have been perfectly just.

Suppose the 8 loaves cost 8s., each person consumed, in *value*, 2s. 8d.

	s.	d.
The first Arabian contributed to the general stock, in value	5	0
Deduct the value of the bread eaten by himself	2	8
Which leaves the value of the bread supplied by him for the stranger	2	4
The second Arabian contributed to the general stock, in value	3	0
Deduct the value of the bread eaten by himself	2	8
Which left the value of the bread supplied by him for the stranger	0	4

It therefore follows, that as 4d. is 1-8th of 2s. 8d. (the value of bread consumed by the stranger also), the contributor of the 3 loaves could be entitled to only 1-8th part; while the contributor of the 5 loaves had a just right to the other 7 parts of whatever the money might have been which the stranger left at his departure.

BY J. H. OF W.

A had 5 loaves, $= \frac{15}{3}$;

B had 3 ditto $= \frac{9}{3}$.

On C joining them,

A had $\frac{8}{3}$ loaves, or $\frac{7}{3}$ less than his original share.

B had $\frac{8}{3}$ loaves, or $\frac{1}{3}$ less than his original share.

C had $\frac{8}{3}$, for which he paid 8 (pence)

$\therefore$ Value of $\frac{7}{3}$ due to A $= 7$

Ditto of $\frac{1}{3}$ due to B $= 1$

(ALGEBRAICALLY), BY MR. W. DOWLING.

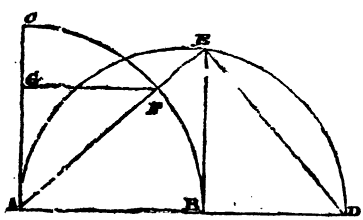
Let a = the 8 loaves; then will $\frac{a}{3}$ = the quantity consumed by each person; whence $\frac{5a}{8} - \frac{a}{3} = \frac{15}{24}a - \frac{8}{24}a = \frac{7}{24}a$, the quantity furnished for the stranger by him who had 5 loaves; and $\frac{3a}{8} - \frac{a}{3} = \frac{9}{24}a - \frac{8}{24}a = \frac{1}{24}a$, the quantity furnished by him who had 3 loaves: the money, of course, must be divided in the same proportion.

Similar answers received from J. L. S. —Q.—J. Long—W. D.—Octavius—and Luzitanus; the last of whom (a Spaniard), expresses a fervent wish "that every sentence given by the judges of more civilized nations, including that of the beloved Ferdinand, were as just as that of the Arabian magistrate.

SOLUTIONS OF THE GEOMETRICAL PROBLEM, (No. 194, p. 296).

Sir,—I send you a solution of the Geometrical Problem proposed in No. 194, page 296, of your interesting Magazine.

Prob. Determine, geometrically, that arc of a given circle which has its cosine and tangent equal.



Let A B C be a given quadrant of a circle. Produce A B to D, so that A B. B D = A B² (29 and 6, Playfair's Euclid), and upon A D

describe the semicircle A E D; draw B E perpendicular to A D; join A E, meeting the given circle in F, draw F G perpendicular to A C: then will B E, the tangent of the arc B F, be equal to F G, the cosine of the same arc.

Join E D; then $AD \cdot DB = DE^2$ (8 and 6 Elem.), and, by construction, $AD \cdot DB = AB^2 \therefore AB^2 = DE^2$; consequently $AB = DE$; and because the triangles A G F, E B D, are similar, $AF : FG :: ED : EB$. But $DE = AB = AF \therefore FG = EB$: hence the truth of the construction is established.

From the above construction the following deductions may be easily demonstrated:—

Assume the arc $BF = A$, $AB = 1$, $BE = GF$.

1st. Cot. A = sec. A.

2nd. Cos. ^2A = tan. ^2A = sin. A.

3d. Sin. ^2A + sin. A = 1 $\therefore$ sin. A $= \frac{1}{2}(\sqrt{5} - 1)$.

4th. Tan. ^4A + tan. ^2A = 1 $\therefore$ tan. A = cos. A $= \sqrt{\left(\frac{1}{2}(\sqrt{5} - 1)\right)}$

5th. Cosect. A = 1 + sin. A $= \frac{1}{2}(\sqrt{5} + 1)$.

6th. Cotan ^4A — cotan. ^{2} = 1 $\therefore$ cotan. A $= \sqrt{\left(\frac{1}{2}(\sqrt{5} + 1)\right)}$ = sec. A.

7th. Ver. sin. A = 1 cos. A $= 1 - \sqrt{\left(\frac{1}{2}(\sqrt{5} - 1)\right)}$

8th. Co. ver. sin. A = 1 — sin. A $= \frac{1}{2}(3 - \sqrt{5})$.

9th. The arc A = 38° 10′ 22″.

I am, Sir,
Your obedient Servant,
G. S.

We have received also a very logical solution of this problem from our esteemed correspondent, Mr. M'Kinnon. He has been at the trouble, however, to find the radius by a construction, when the radius is, in fact, contained in the terms of the problem. He makes, also, the arc 28° 10′ 21″; while G. S. makes it 38° 10′ 22″. His numerical value of the sine of the arc is $\frac{1}{2}\sqrt{5} - \frac{1}{2}$; being exactly the same as G. S.'s in Deduction Third, only somewhat differently expressed. This surd Mr. W. reduces to ·618; and, so far as he has carried the decimal calculation, he is correct. If the decimal, however, be extended to seven places, the natural sine of the arc will be ·6180340, and this will, in any table of natural sines, be found to correspond with 38° 10′ 21″ 45‴ (pushing the calculation to its farthest limit): so that G. S.'s answer is true to the nearest second; and Mr. M'Kinnon's error is evidently but a slip of the pen.

In our next we shall give an *algebraic* solution of this problem, by a French correspondent, who deduces from the final equation, a geometrical construction. His method of finding a general value of the sine of the required arc will be found very neatly done; and his solution, upon the whole, highly creditable to his talents; although constructions obtained by this method are generally less elegant than those derived from pure geometry. Our French correspondent's solution is just the converse of G. S.'s. The former has obtained his construction from algebra; the latter has derived his algebraic deductions from pure geometry.

Other solutions of this problem (but all more or less incorrect or deficient) have been received from K. Y. L.—M. A., of Brazen Nose—Edinensis—S. S.—and A. B. D.

NOTICES TO CORRESPONDENTS.

Mr. Shire's curious theory of a solar fluid, in our next.

W. C. P. will find a similar explanation given at p. 113, Vol. II.

Communications received from Mr. T. H. Bell—Mr. Baddely—Tim Bobbin—W. C. P.—H. Foord—W. James—H. O—T. C. E.—J. Stennar—P. of C. C. Acad.—Keah Samoht—Inquisitus—Ajax.—S. C. Todd—F.—Societas—W. D.—Viator.

Erratum—p. 69, 1st col. 18th line, for *per mile* read *per minute*.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 210,] SATURDAY, SEPTEMBER 1, 1827. [Price 3d.

"Long time the sister art, in iron sleep,
A heavy Sabbath did supinely keep."

DRYDEN,

ST. MATTHEW'S CHURCH, BRIXTON.

THE expenditure of a million of money in the erection of new churches would have probably been viewed without a grudge, even by the most rigid economists and dissenters, had the style of these churches been such as to do honour to the architectural taste of the age. So far, however, is this from being the case, that they are, with few exceptions, such as would do no honour to any age. Excelled they are a thousand times by structures reared centuries ago, and in times of comparative ignorance and rudeness. In our new churches alone we see no marks of advancement, but, on the contrary, the strongest signs of a taste degenerated into depravity. In vain do we look around among them for any prevailing feature of simplicity, or grandeur, or beauty. Novelty they have in abundance; but it is a novelty consisting not in bold, original, and scientific conceptions, but in petty conceits, grotesque combinations, and paltry results. The earth has

had so many additional loads of gimcrackery heaped upon it, and that is nearly all we have had for our money.

We found this judgment chiefly on a survey of the new churches in and around the metropolis; but we have heard nothing to induce us to suppose that those erected in other parts can boast of any purer taste.

Among the "few exceptions" to which we have alluded, is the church of St. Matthew's, Brixton, with a good view of which, our engraver Mr. Walker, has enabled us to embellish the front page of this week's number. The *western* front of it, which you pass on the left in journeying to Brighton, is perhaps the only part of it, however, which claims admiration. It is in the Grecian Doric style, and an exact copy, on a small scale, of the Parthenon at Athens. The columns are of six diameters high—the proportion best adapted to exhibit the solid grandeur of this order of architecture. One blemish, and only one, struck us in viewing this delightful specimen of classic taste. Of three doors, which open from this front into the interior of the church, the centre one only corresponds in situation and width to the intercolumniation in front of it; the others are each placed behind a pillar, and being only obliquely and partially seen, mar that uniformity which it would have been so pleasing to see observed in this otherwise faultless piece of architecture. Of the *eastern* front, with the tower or spire above it, we can say nothing commendatory; it is too like what the majority of our new churches are, and too little akin to its classical neighbour, to excite other feelings than disappointment and regret. The adoption of the Doric column in the tower—a column which has no pedestal or base, because it should invariably have the *ground* for its basement—is particularly objectionable.

The architect of this church was Mr. C. Porden; and considering the limited means placed at his disposal (less than 15,000*l.* we have heard), it does on the whole considerable credit to his professional talents.

NEW AND EXPEDITIOUS METHOD OF SQUARING NUMBERS.

Lincoln, July 2, 1827.

Sir,—Whatever has a tendency to diminish the labour of dry and tedious calculations, can hardly fail to be acceptable to some of the readers of the Mechanics' Magazine: with this persuasion, I make no apology for submitting to them a method, by which a considerable part of the usual labour of squaring numbers may be avoided; a method, which, though it embraces no new principle, seems, as far as I know, to have been hitherto unnoticed by every writer on the subject of arithmetic.

The method here pointed out is founded on the well known principle, that the product of the sum and difference of two numbers, is equal to the difference of their squares; to which difference, if we add the square of the lesser number, we obtain the square of the greater. The principal advantage of this method is, that it enables us to perform the operation, with numbers divisible by 10, 100, &c., or which contain cyphers. If we make the number, the square of which is required, the greater of two numbers, whose sum or difference is a number divisible by 10, &c., and multiply together the said sum and difference, and to their product add the square of the lesser number, the result is the square required. For example: let 83 be a number whose square is required; then $83+3=86$, and $83-3=80$, the sum and difference; the product of which is 6880; to which add 9, the square of the lesser number 3, and we have 6889, the square of 83. If the number to be squared ends with 5, the process is still shorter, for taking 5 for the lesser number, the sum and difference are both divisible by 10: thus, $85+5=90$, and $85-5=80$; whence $90\times80+25=7225=85^2$.

The intelligent reader will perceive, that in every case we save the trouble of multiplying by at least one figure; and, in many cases, of much more. For example, take 997; then $997+3=1000$, $997-3$

$= 994$; by a mere mental process we obtain 994009, the square required.

It is presumed sufficient has been said to explain the above method and to show its utility. It is equally applicable to whole or mixed numbers, fractional or decimal, and may frequently be applied with singular advantage in all. Take, for instance, the famous "Arithmetical Question" which called forth the mental energies of so many of your correspondents in your first volume. We have 99*l.* 19*s.* 11¾*d.*, or $99\frac{959}{960}$, and $\frac{1}{960}$; their sum 100, their difference $99\frac{958}{960}$; their product is instantly obtained $= 9900\frac{9590}{96} = 9999\frac{76}{96}$, or 9999*l.* 15*s.* 10*d.*, to which add $(\frac{1}{960})^2$ or $\frac{1}{960}$ qrs., and the answer is obtained. Perhaps it may be still more readily done without reducing to fractions; thus 99*l.* 19*s.* 11½*d.* × 100 = 9999*l.* 15*s.* 10*d.*, to which add $\frac{1}{960}$ qrs. as before. On this question allow me to say, that entertaining the same views as your former correspondents, I have no wish to revive a subject, which together with the contentions it excited, has long since descended to "the tomb of all the Capulets;" yet, as it was allowed on all hands that the answer required was the square of the number $99\frac{959}{960}$, I trust that the calling in its aid to illustrate my subject, will not be thought derogatory to its posthumous fame.

I now proceed to inquire how far a similar method can be applied with advantage to the finding the products of numbers in general. Let a and b be two numbers, whose product ab is required, a being the greater; let $a + r$ and $b - r$ be two other members, one or both of which is divisible by 10; it is evident that $(a + r)$ $(b - r)$ is less than ab: let n be the difference; then $(a+r)$ $(b-r) + n = ab$, an equation in which $n = (a-b+r)\,r, = (d+r)\,r$ when $d = a - b$. And this value of n, added to $(a + r)$ $(b - r)$ we have ab as required. Again if it be convenient to take $a - r$ and $b + r$ for the two auxiliary numbers, then because $(a - r)$ $(b + r)$ is greater than ab, let n be the difference, and we have $(a - r)$ $(b + r) - n = ab$, whence $n = (a-b-r)\,r, = (d-r)\,r$; which substracted from $(a - r)$ $(b \times r)$ gives ab as before: from hence we obtain the following convenient general rule. Arrange the four numbers like the terms of a proportion in the following order:—$a \times r$, a, b, $b \times r$. "Find the product of the difference between the first and second, and first and third terms, which is the value of n; then, if the first term be greater than the second, *add n to* —, if less, *subtract it from* the product of the extremes; the result is the product of the mean terms."

As my object is to write intelligibly rather than learnedly, I hope an example or two will cause it to be understood by all. Let the numbers whose product is required be 96 and 93; then, taking $2=4$ and arranging as above directed, the terms will stand thus: 100, 96, 93, 89. The product of the extremes is 8900, to which add $(100-96)$ $(100-93)$, or $4 \times 7, = 28$, the value of n, we get $8928 = 96 \times 93$. Again, let $a = 95$, $b = 85$; then $a - r = 90$ $b + r = 90$; the terms will stand thus, 90, 95, 85, 90. And we have $n = (95-90)\,(90-85)$, or $5 \times 5 = 25$, which, as the first term is *less* than the second, must be subtracted from 8100, the product of the extremes; the result is 8075, the product required.

From the above examples it appears, that when the numbers are such that the value of n can be obtained mentally, or with little trouble, there is a decided advantage in using this method. I have neither time nor inclination to pursue this subject further at present, but should be glad to see it taken up by some one better qualified for the undertaking; what I have done, I submit, with great deference, to the judgment of the candid and judicious reader.

J. B.

P.S. Since the above was written, I have had the pleasure of witness-

ing the surprising powers of Master Noakes, a child of seven years old, who is now itinerating in this county, for the purpose of displaying his abilities in arithmetical computations. I was much gratified to find, that in the squaring of numbers, he uniformly made use of the above method. Whether he has been taught it, or whether it *suggested itself* to his extraordinary mind, I did not ascertain; nor is it of consequence to know; it is sufficient that we have, at least, *his* approbation in its favour.

ON THE DIFFERENT KINDS OF FOOD.

(*See* pp. 7, 39, Vol. VIII.)

Sir,—I have perused the letters of Globosum in your late Numbers, and being of opinion that many of his statements are erroneous, and some ridiculous, I hope you will insert the following observations by way of antidote. The wide circulation which your Journal will give them, is a powerful reason with me why they should not go unanswered.

I certainly should not have suspected your correspondent to have been a medical man, if he had not so informed us; for he plainly betrays a want of acquaintance with some of the first principles of *our* science.

"Vegetable food," he says, "is the most natural to man." This is more than he can prove. The contrary I believe to be the fact, as all men, in a state of *nature*, seem to have chiefly lived upon animal food; eatable vegetables there being few or none, and Providence having supplied an abundance of animals. It is the refinement of modern times that has brought such a variety of plants into use: indeed, we owe to cultivation the whole of our vegetable food. The apple was a vile crab, and our most succulent roots mere woody fibres, or poisonous bulbs. The potato is a remarkable instance, being, in its native clime, a poisonous plant: and the different kinds of grain, in the wild state, were unproductive, or unfit for human food. Such tribes as in our own day are still in a state of *nature*, live almost entirely on animal flesh, and derive but little subsistence from the vegetable world. For what purpose were the cow, the deer, the sheep, the pig, created? For their milk, their horns, their wool, the hair alone? This is hard to be believed. As respects the pig, it certainly *was* intended to be eaten in temperate climates; and a wise ordination it was—for, by it, that "offal" which would otherwise have been of little use, is transformed into a highly nutritious food, which, with potatoes, forms the chief support of millions of human beings. As well might G. contend that the lion, man's great representative, was not designed to eat animal food. In investigations of this nature, matter of fact and authentic history can only be admitted: the visionary stories of the poets, and Utopian dreams of philosophers, are inadmissible.

Now for his anatomy, his chemistry, and his botany; but first of all, his *charity*. Like Mr. Accum, he seems strongly impressed with the idea that every dealer in human food must be a rogue. This prejudice cannot be too strongly reprobated. I know dealers in such things, who are men quite as conscientious as Globosum, be he who he may. "All the retailers," says he, "will become irritated, like wasps, croaking for their loss of trade, on the people adopting my plan." Again, "these worthies (the bakers) convert down-stairs into a very laboratory." And all this, without one qualifying, one redeeming expression. O Charity, where is thy smile? O Shame, where is thy blush?

His frothy tirades against salt are quite amusing. "The pain," he says, "which gouty and rheumatic persons frequently experience on the approach of rain, is owing to the humidity attracted by salt in their bodies;" and this he very scientifically illustrates, by referring us to the fact, that a stone brought from the sea-shore becomes moist on the approach of a shower, and in cloudy weather!

"Salt, vinegar, spirits, &c. generate oxygen; the presence of which is always manifest in cases of rheu-

matism, gout, scorbutics," &c. This ill accords with the practice of Dr. Middleton, who has afforded so much benefit to his patients by the employment of a bath strongly impregnated with oxygen. The supposition of Globosum, that acid is a very common cause of gout, &c. is untenable. "The redundant acid, therefore, which Dr. Middleton finds, is the effect, and not the cause, of that vitiated state of the assimilating organs, especially of the stomach, and consequently of the general system, which constitutes a fit of the gout." *

"The acids contained in salt, spirits, wines, vinegar, and alum, generate," says your correspondent, "most of the prevailing disorders." The acid contained in salt is completely neutralized by the soda, and cannot be decomposed by the powers of the stomach; it therefore acts neither as an acid nor an alkali; it is a gently stimulating neutral salt, and, as a corrector of putridity, is, perhaps, little inferior to the more fashionable articles—chloride of lime, chloruret of sodium, &c. Spirits, it is true, may become acid in the stomach, but the idea of spirits containing an acid is ridiculous.

"The white grains—viz. wheat, oats, barley, rye, &c. taken into the human constitution, feed the muscles and nerves. All the pulse kind, as peas, beans, &c. nourish the flesh and bones, and sweeten the blood. The former class affords gluten, the latter carbon. *Leguminous* plants, as cabbages, turnips, &c. purify and cool, as the whole tribe contains hydrogen." This is ultra-chemistry indeed! Whence got *Globosum* that sublime piece of knowledge that the grains feed the *muscles* and nerves, and that the pulse kind nourish the *flesh* and bones, and sweeten the blood? What is the difference, good Doctor, betwixt muscle and flesh, and flesh and muscle? Cabbages and turnips, *leguminous* plants!! That Globosum's cabbages and turnips may produce peas and beans, I will not deny; but certainly it would be considered quite a phenomenon in this part of the country. But it seems "cabbages and turnips cool and purify, as they contain hydrogen," as if the white grains and the pulses did not contain hydrogen as well.

To notice the whole of his singular opinions would but encumber your pages to no purpose, as I have said quite sufficient to satisfy your intelligent readers.

I am, Sir, &c. &c.
BENJ. GOULSON,
Surgeon.

Pendleton, Aug. 14, 1827.

[We shall be glad to hear from Mr. G. on the subject of his Postscript.—EDIT.]

THE PATENT LAWS.

Sir,—I take the liberty of troubling you with this, in consequence of the part which you have taken in your valuable journal on the subject of the patent laws; feeling convinced, like you, of the impolicy of subjecting patentees to the immense expense which they are at present obliged to incur in taking a patent out, and of the great injury, public and private, which is occasioned by the existing state of the law in regard to new inventions.

My particular object in this letter is to advert to some of the objections offered by your correspondent, Mr. Deykes, to reducing the expense of patents. "Who," Mr. D. asks, "in one part of the country, could be certain that he was not infringing the cheap patent of another man in a different and distant part?" Now, what the matter of cheapness has to do here, I cannot possibly conceive. Would not the same difficulty apply to a patent for which you have paid 300 pounds, as to one which cost you only 300 pence? Mr. D. next exhibits, in dread array, the costs of "bills of equity—injunctions—issues at law—special cases," &c. But here again I would ask, whether the pressure of such costs is lessened by making the previous expense of taking out the patent three hundred times greater than

* See a Review of Dr. M.'s work, in No. 204 of the Lancet.

there is any occasion for? I will confess, that if patents are made cheaper, there will, in all probability, be more of them (it would be idle to seek for an alteration of the law, unless such were to be the effect produced); and that as men of genius are still as likely as ever to be of the poorer order, there will be only so many more opportunities for rich rogues to defraud them—trusting, as they will probably do, to the inability of the poor patentee to vindicate his rights by due process of law: but, as a suitable rider to any bill for abolishing the charges on patents, I would have a clause enacting, that any person *knowingly* infringing the patent right of another, should incur the penalties of felony, equally with all other sorts of thieves and robbers. Whether it be true, that "the right" of granting a patent is "inherent in the Crown"—as Mr. Deykes assures us it is—is a point of no consequence; for Mr. D. afterwards admits, that any right which the Crown possesses in regard to this matter, is held "in behalf of the state," and "for the benefit of the state;" and the ground on which you have very properly rested the argument for an abridgment, or rather the entire abolition of that right is, that it will be for *the benefit* of the state that it should be so abridged, or abolished. Only think what *the right* is for which Mr. D. contends! A right in the King—a patriot King too—and in the keeper of the King's conscience, and all the various officers in authority under them, to fasten, like so many hungry leeches, upon every patentee who may have been guilty of inventing or discovering something advantageous to his country!!! Away with the *false* zeal that would make either the King, or any one of his officers, a party to the continuance of a right so odious and oppressive. Indemnity for what that right now produces to the officers of the Crown is the utmost they can, or I am persuaded *will*, ask from the country in the event of its abolition. The whole question, in fact, seems to resolve itself into this—whether the officers of the Crown shall retain some few thousands a-year, or the country lose as many hundred thousands, or perhaps millions? I have never yet heard of any attempt to defend the grievances of which patentees complain on *public* or *national* grounds. As vain, indeed, would it be to contend that it is good for a nation to be without useful inventions, as that it is good to discourage them (as is done at present) by all possible means. With you, then, I say, let us have neither "*payments by instalments*," nor "*ad valorem duties*" on the profits resulting from the genius and industry of the poor mechanic; but let inventions in the arts be placed on the same cheap and easy footing with works in literature, and to which they are, beyond all question, equally entitled. Trusting that your Petition will have the desired effect,

I remain, Sir,
Your obedient Servant,
THOS. DOUSBERY.

THE NEW GATEWAY, HYDE PARK.

Sir,—It is with much pleasure I have read an excellent critique, in No. 208 of your very valuable Magazine, on the new building lately erected at Hyde Park Corner: but you have been led into error respecting the execution of the works. You state Mr. Decimus Burton to be the designer *and builder*, which is not the fact; Mr. Burton being the architect, and Messrs. Bennett and Hunt, of Westminster, the builders. It is also stated that Mr. Henning is the designer of the frieze over the centre gateway; this is also incorrect, as Mr. H. is only employed to execute the work.

I trust to your usual truth and candour for the insertion of these few lines, and remain,

Sir,
Your most obedient Servant,
VERAX.

London,
August 27th, 1827.

CLUBS FOR SCIENTIFIC MATERIALS.

Mr. Editor,—There are certain books and instruments, or what I would call *scientific materials*, which every admirer of science would gladly possess, but the value of which frequently places them beyond the reach of many a votary of real knowledge. Amongst those materials, I consider the following are *essential:* —Hutton's or Barlow's Dictionary; a case of good instruments, and set of tables, in mathematics; a pair of globes, an atlas, a quadrant, and a telescope, in astronomy and geography; a thermometer, barometer, and solar microscope, in natural history. These are *essential:* but there are many other articles *desirable*, according to the peculiar views and pursuits of individuals; such as surveying instruments, a pentograph, &c. In possession of these materials, a person may set forward in his scientific inquiries with precision and certitude; he may contemplate the heavens with the eyes of Herschel; mete the fluctuations of the atmospheric phenomena; and, in short, bring under his immediate inspection all those subjects of which Mechanics' Institutions, those magazines of human experience, afford the full developement. In large towns, such materials can often be purchased cheap; but in the country there are no such facilities. It may therefore deserve the consideration of booksellers, of dealers in mathematical instruments (who in the country are generally and very properly clock and watch-makers) or the more active members of Mechanics' Institutions, to establish clubs for supplying individuals with these materials of science. In the country it is customary to form clubs for clocks and watches, and these clubs for scientific materials might be conducted on the same plan. The advantage of possessing such materials in families, is not to be estimated by their mere utility to the enlightened possessor of them; for I have no doubt but that a scientific instrument or treatise, by merely falling in the way of a boy, has frequently given a stamp to his future character, made him a man in the true acceptation of the term, and thus evinced the moral effect of physics.

T. H. BELL.

Alnwick, 16th July, 1827.

METHOD OF TAKING IMPRESSIONS OF MEDALS OR COINS.

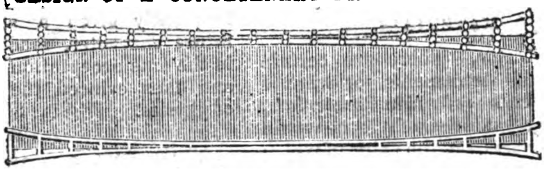
Sir,—The following is a method of taking impressions of medals or coins with isinglass. Take an ounce of isinglass; beat it in a mortar; then pick it into small pieces, put them into a half pint phial, and then fill it up with a spirituous liquor (common brandy or geneva will do); put a cork into the phial with a notch cut in one side of it for a passage of air, and then set it by the fire for three or four hours, shaking it often in that time; (the heat should be great enough to keep it near boiling all the while.) The isinglass will then be sufficiently dissolved, and the whole must be put into a cloth, and strained off; it must finally be put into a clean phial, well corked, and kept for use.

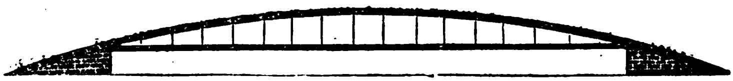
When it is wanted for use, take the glue and set it by the fire, and it will soon liquify or become fluid; then having made the medal clean, and placed it quite level, pour on as much of the glue as will cover it completely over and lie without running off. It must then be let stand to dry, (which in the summer time and dry weather will be but one or two days;) when it is quite dry, it must be taken off by entering the point of a pen-knife under one side, and it will rise off the medal in a clear, transparent, and perfect resemblance of the whole, and even the most minutest parts of it.

I am your's, &c.
JAMES COX.

June 5, 1827.

DESIGN OF A CONCATENARY FRAME BRIDGE.





Mr. Editor,—I transmit you the plan of a concatenary frame bridge, a model of which I presented for the inspection of the Newcastle Mechanics' Institution. The platform is supported by a frame at each side, composed of two oaken ribs, placed obliquely and laterally, so as to form a catenary inverted. Between the ribs, and forming part of the frame (for they retain the ribs in their position), are transverse bars, or pieces of timber; along which, and over each rib, passes a chain, which at once secures the frame, by being braced round it at every transverse bar, and serves to suspend the platform. The obliquity of the ribs, by preventing cant, causes it to stand firmly on the abutment. The chief advantage of this bridge would be its cheapness and lightness. It would not requre heavy abutments, and might be useful where the bed or banks of a river would not admit of heavy stone structures. It would form a light and graceful curve in pleasure grounds.

Alnwick. T. H. Bell.

MEANS OF PRESERVING PARKER'S CEMENT FROM DISCOLOURATION.

In answer to Senex's inquiry (page 343, Vol. VII. of your valuable work), I would recommend to him to paint the walls covered with Parker's cement, with a composition invented by Messrs. Charles Francis and White, manufacturers of *mastic cement*, at Nine Elms, Vauxhall. They call this paint *lithic paint*, and state that it is effectual in preventing the Parker's cement from turning green; but the mastic cement itself, laid on at once, I think better, having tried it: it is rather expensive, however, and was the invention of M. Hamelin, a Frenchman, who took out a patent for it about 40 years ago. A person of the name of Cook, who lived at Wapping, or Ratcliffe, invented a paint which he called *anti-corrision*, the basis of which was common glass-bottles reduced to powder, and mixed with linseed oil. This patent, of course, has expired long since; and whether it is now to be had, I do not know, but I think it would answer Senex's purpose: I tried it upon wood-work out of doors, and it effectually kept out wet, and did not stain, and lasted a great many years. Any colouring matter might be added to it to give the shade required. Glass bottles, when finely pulverized, produce a whitish powder, but so ponderous, that the paint must be stirred every time the brush is put in; its grittiness, too, wears the brushes out very fast. Cook's anti-corrosion was very much used in the Royal Arsenal at Woolwich, to paint cannon and other iron-work, which it preserved from rust; probably there was some other ingredient in it, to facilitate its drying. Hamelin's cement I once supposed to be called *mastic*, from an admixture of that gum, but I have since learned it is a French term, signifying cement or mortar, mixed with oil instead of water.

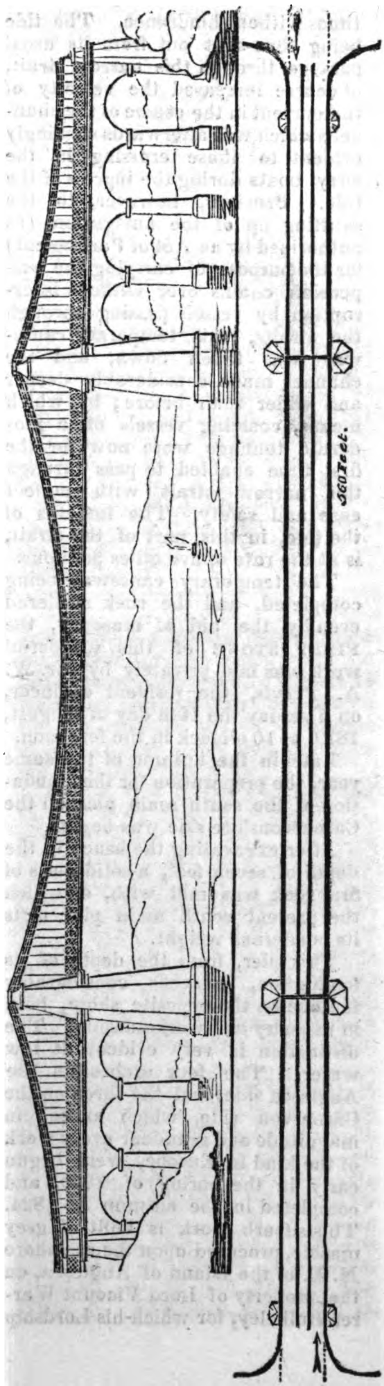
I am, Sir,
Your obedient Servant,
An Amateur Mechanic.

NARRATIVE OF THE BUILDING OF THE MENAI SUSPENSION BRIDGE.

Sir,—In the summer of 1826, I made a tour through a part of North Wales; and amongst the objects which most excited my curiosity, and which were most worthy of attention, there were none that I beheld with more admiration and astonishment than the suspension bridge over the Straits of Menai, (see annexed sketch) and the superb aqueduct over the Vale of the Dee, called Pont Cyssylttir, both of which were designed and erected under the direction of Thomas Telford, Esq. and will remain long-enduring proofs of his eminent genius.

As the Mechanics' Magazine is a repertory of arts and sciences, and as I am not aware that any description of the Menai Bridge has appeared in your interesting publication, I will, with your permission, give some of the particulars of this stupendous work, which may perhaps both amuse and instruct your readers. The account which I shall furnish, will be from the narration of Dr. Pringe, who resided about a mile from the spot where the bridge is erected; and who was frequently led there by the novelty of the structure, and had observed its progress with considerable attention.

The first process towards the erection of this truly magnificent and unrivalled bridge took place in the month of May, 1819, by blasting, and removing the inequalities of the rock called Ynys-y-moch (which at that time was accessible only at low water) to an even surface, in order to form a solid foundation for the north main pier on the Anglesea side. For this purpose, in a few months afterwards, the intermediate space between the Anglesea shore and the rock was filled up with a temporary causeway of stone-work, wide enough to admit of a rail road for sledges drawn by horses, and which, being considerably elevated above high-water mark, afforded the workmen an opportunity of passing and repassing to their various occupations at all



times without hindrance. The tide being thus shut out from its usual passage through this narrow strait, of course increased the velocity of the current in the centre of the channel; which was afterwards strikingly evident to those crossing in the ferry boats during the ingress of the tide. Previous, however, to the shutting up of the navigation (as authorized by an Act of Parliament) for the purpose of carrying the suspension chains over without interruption by vessels passing through the straits, this temporary causeway was taken down, and the channel made considerably deeper and wider than before; by which means, coasting vessels of a moderate tonnage were now for the first time enabled to pass through this narrow strait with perfect ease and safety. The impetus of the tide, in this part of the strait, is at the rate of five miles per hour.

The temporary causeway being completed, and the rock rendered even by the aid of masonry, the FIRST STONE of this wonderful work was laid privately by Mr. W. A. Provis, the resident engineer, on Tuesday the 10th day of August, 1819, at 10 o'clock in the forenoon.

Late in the autumn of the same year, the preparation for the foundation of the south main pier on the Carnarvonshire side was begun.

After excavating the beach to the depth of seven feet, a solid mass of firm rock was met with, on which the present south main pier rests its ponderous weight.

This pier, from the depth of its foundation, exceeds considerably the one on the opposite shore, both in masonry and workmanship. The distinction is very evident at low water. The four arches on the Anglesea side, and the three on the Carnarvon side, which exceed in magnitude and grandeur every work of the kind in Europe, were begun early in the spring of 1820, and completed in the autumn of 1824. This superb work is built of grey marble, procured upon the sea-shore N. E. of the Island of Anglesea, on the property of Lord Vicount Warren Bulkeley, for which his Lordship was paid sixpence per ton by Government. It is proper to observe, that the abutments of the two main piers are not formed of a solid bed of stone work all the way up; on the contrary, eight hollow squares (four in each pier) were left near the centre of the abutments (commencing above high-water mark), and continued up perpendicularly nearly to the level of the road-way, which, as the pier advanced in altitude, were regularly worked within, and closely cemented with mortar, in the same manner as the external face of the pier. After the completion of the seven arches (before mentioned), the small arches intended for the road-ways were constructed, each being 15 feet to the spring of the arch, and 9 feet in width, through which carriages, &c. are to pass.

After the arches were turned, the suspension piers were further elevated, tapering gradually in a pyramidical form, to the height of 53 feet from the level of the road, by solid masonry; each stone being bound with iron dowels, from the top to the bottom of the suspension piers, to prevent their being separated or bulged, by the immense pressure of the supension chains.

The next process was the *iron* department. On the extreme height of the suspension piers are placed the cast iron blocks or saddles (with wrought iron rollers and brass bushes) for the purpose of regulating the contraction and expansion of the iron, by moving themselves either way as may be required according to the temperature of the atmosphere, without causing the least derangement in any part of the work. These rollers are most ingeniously constructed, and form a desideratum in this line of bridge building. In my next, I shall give a description of the suspension chains, the mode of fixing them, &c. &c.

I am, Sir,

Your's respectfully,

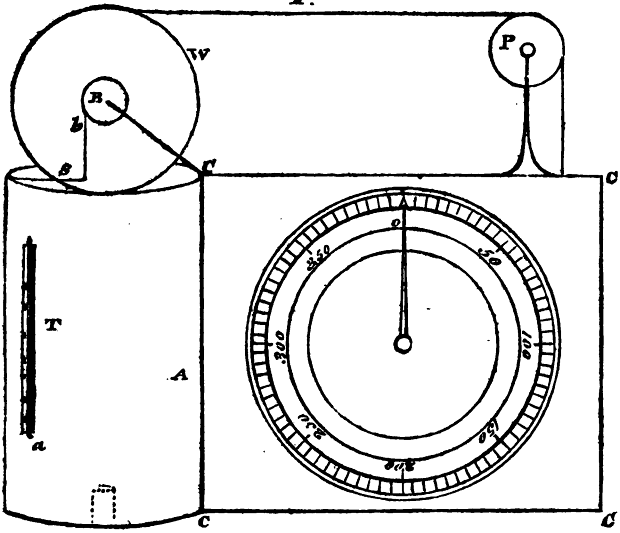
T. B.

Manchester, August 1st.

(To be continued in our next.)

DESCRIPTION OF A FRIGORIMETER, OR INSTRUMENT FOR MEASURING THE CONTRACTION OF METALS BY COLD.

1.



Sir,—I invented the following instrument about two months ago, for the purpose of measuring the contraction of metals by cold, and propose to call it a Frigorimeter.

Fig. 1. A is a cylindrical vessel of thin tin-plate, having a thermometer affixed to it. T, the thermometer, is furnished with a graduated scale, and is bent at *a*, where its bulb enters the vessel A. S is a spring fixed to the inside of the vessel A, in the manner represented by fig. 2, where *a* is the part fixed

2

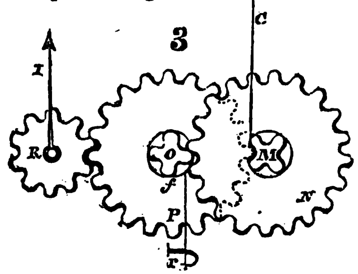
to A, and *b* the part which rests upon the end of the metallic bar whose contraction is to be measured. It is fastened to A by a nut, which being slackened, the spring S may be turned aside to admit the metallic bar into its place. To S is fastened a string *b*, the other end of which winds round the axle B of the wheel W. To W is attached a string, which passes thence over the fixed pulley P down into CCCC, where it acts upon wheel-work so as to cause the circular index to turn round two hundred times, when the bar contracts one inch. The circle is divided into 400 divisions; if then the bar contract the 80,000th part of an inch, the index will pass over one division of the circle.

To use this instrument, slacken the screw which holds the spring S, and introduce the bar. Replace S, and slacken the nut which fastens the index, which set to the 400th degree. Observe the degree of heat indicated by the thermometer; then pour into the vessel A a frigorific mixture. Observe how many degrees the thermometer sinks, and likewise the degree on the graduated circle to which the index now points.

The inside of the frigorimeter is thus constructed. (See fig. 3.) The string *c* passes round the axle M of the wheel N. The teeth of the wheel N, which are 20 in number, take into the leaves of the pinion O, four in number. P, of 20 teeth, on the same axis with O, turns the pinion R of five leaves. The index is fixed on to the axis of the pinion R. Around a groove cut in

the pinion O a string f is wound, and proceeding thence is fastened

3



to the end of a spring r. The groove cut in the axle B is to the groove cut in the wheel W as 1 to 5; the axle M is equal to the axle B, and B is half an inch in circumference. The use of the spring r is obvious; for, without it, when the bar is again lengthened, S would rise with it, and the spring b would slacken without affecting the wheel work.

With a little alteration, this machine may be used as a pyrometer; but as many ways of doing so will instantly occur to any person of common capacity, I deem it needless to mention the method I have adopted.

By making use of different frigorific mixtures and bars, the proportionate contraction of different metals at different temperatures may be ascertained.

I am, Sir, your's, &c.

$$H \surd a^2 \frac{a^2}{2} H.$$

PILE-DRIVING.

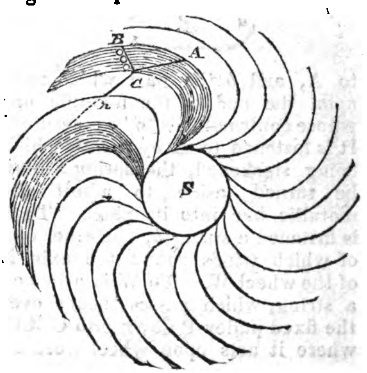
Sir,—As I am ambitious to be considered one of your *ingenious* correspondents, I take the first opportunity of sending to you an answer to the question proposed by Glerum (page 355, Vol. VII). I am surprised, however, that Glerum, who has so much theory and practice in pile-driving, should propose such a question; for had he consulted the table inserted in No. 198, he would have found his question satisfactorily answered by it: I may nevertheless state, for the information of your readers generally, that the question has no maxima or minima, but what are infinite; therefore the greatest effect with the least loss of time and labour is when the height of the pile-engine is infinitely small. By inspecting the table, we perceive that the momentum of a body falling 16 feet is one half of the momentum of the same body falling 64 feet; whereas the labour in raising the body 16 feet is only one-fourth. The same ratio holds with respect to all other heights: for instance, 4 feet has the same ratio to 16 that 16 has to 64. This will naturally suggest to those interested, the propriety of having their pile-engines low, and their rams heavy. I will illustrate this by an example.

By the table, a fall of 4 feet and a fraction, has a momentum of 13; a fall of 16 feet and a fraction, has a momentum of 25: now the labour of raising the ram 16 feet is evidently four times that of raising the same 4 feet; consequently, the same power that will raise any weight 16 feet, will raise four times that weight to the height of 4 feet; but the momentum of such a weight falling 4 feet, will be double that of the other falling 16 feet: that is, with the same labour the effect is doubled. I believe I need not enlarge any farther on this subject.

I remain, Sir,
Your obedient Servant,
A. MACKINNON.

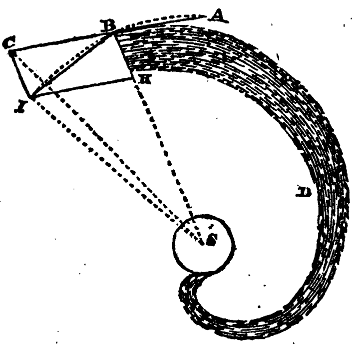
NEW ASTRONOMICAL THEORY.

A Professor at one of our Public Institutions has, in the course of his prelections, started the following ingenious speculation:—



Suppose all planets to be carried off from the sun S in curves, as in the following figure; * each quitting the sun in a western direction, and bending over towards the east for ever after; the results of such a direction being given to them would, he contends, agree precisely with those deduced from the elements in Newton's Principia. This theory having excited considerable curiosity and discussion, we have been favoured by the Professor with the following demonstration of it:—

Demonstration.



Let AB and BI be increments of a planet's orbit, whose centre is S; also AC a straight line, and AB= BC; then, by the first law of motion, an impulse in the direction AC would pass a planet over AB and BC in equal times; but in the time of BC, it falls from B to H, in which time the compound describes BI (see Newton's Principia, Prop. 1st, Vol. I.): now, taking the mean of a planet's motion, and thereby treating the orbit as a circle, the two triangles CBI and IBS are similar isosceles triangles; whence their angles are acute; and because CB = BI, the first law of motion is not altered in quantity by describing the orbit: but since the impulse is resisted by constant reactions from the attractions of other planets, by the sun's light, and other thin fluids, the velocities of planets, as depending on the impulse, must be diminished in every revolution; and though the defect be made up by the increase of the sun's gravity, yet the sun subtends no greater angle than it was always found to do, and therefore we do not get nearer to him. Moreover, since the velocities of planets about the sun are inversely as the square roots of their distances from his centre, and singularly inversely as the distances, it is more reasonable to suppose those motions to arise from the sun, and to be maintained by him, than to consider some *unaccountable* impulse as favouring the sun, and such as cannot be destroyed, and capable of enabling Jupiter to resist the effects of the great comet of 1680, as it nearly did. Whence, seeking causes from effects, let us suppose forcing spirals of solar fluid to bend eastward about the sun, as SDB; this curve of fluid would force the planet B in the direction BC, though not with a constant urgement (unless to defend and restore reactions), and the gravity BH acting as before mentioned, BI would be generated by the compound; and further, because the angle BCI was found to be acute, the force BC is continually diminished by the gravity CI, or BH, (the same thing); and as BI = BC, the increment BI is made up of the aid of gravity of S, and part of the force remaining in BC; whence the force of the fluid at C must offer a greater resistance than at I, because in BI both forces act in favour with each other: if therefore CI be considered the diameter of a planet, it follows that the resistance of fluid in the direction BC on the right side of the planet, is greater than on the day side BI next the sun, and the planet will thereby turn on its axis nearly in the same direction as in its orbit, (as we find), but with a quicker diurnal rotation, as its density is less, and it is more easily affected by external causes. Hence it may be that the planets Jupiter and Saturn perform their diurnal rotations in far less time than the earth,

* The reader will please to overlook the letters of reference in this figure, the explanation which they illustrated having been superseded by the fuller demonstration hereafter given.

(as we find). By like arguments, it also turns out that the plane of the fluid attends primaries, acting parallel to itself, and also to the equator of the planet; and therefore the position of the axis does not sensibly alter during the planet's year. And further, from the above I find the fluid to wind itself about the primary as about the sun, but more in a mass; the moons are also thereby revolved, but not rotated like primaries, (this we find). An increment of the above-mentioned fluid curve is got from the ratio of the gravity, and corresponding velocity in the orbit, jointly, which curve, if it passes through the aphelion of any one primary planet, will also pass through that of the other primaries; showing the resistance of the fluid to be stronger in that situation than in the opposite side of the orbit, where its loss admits the sun's gravity to draw them to perihelion.

Let this fluid, then, be also granted to exist, its momentum being determinate, and compounded with the plural of gravities (see Prop. 7th and 8th, Vol. 2, Newton's Principia, on Gravity), the motion of the solar system, and of its parts, will admit of a more ready, simple, and satisfactory solution, by this means, than I find otherwise to arise.

Note. The above can only be truly judged of by those who can read *to understand* the astronomical part of Newton's Principia.

ON THE SOLUTION OF IMAGINARY OR IMPOSSIBLE QUANTITIES.

Sir,—In No. 196 of your valuable Magazine, Mr. F. Ford takes notice of an error in Mr. Darley's Algebra, where it is stated that $\sqrt{-a} \times \sqrt{-b} = +\sqrt{a\,b}$. Mr. Ford contends that it should be $-\sqrt{a\,b}$. In a subsequent Number, (198) Mr. Henry O—y endeavours to prove that Mr. Darley is *right*, and at the same time admits that Mr. Ford is *correct;* this seeming anomaly he accounts for by informing us that the true product is $\pm\sqrt{a\,b}$; that is, that Mr. Darley has produced *one half* of the truth, and Mr. Ford *the other half;* so that between them we are put in possession of the *whole truth.*

We shall now recapitulate Mr. Henry O—y's proof:—"The square of $\sqrt{-a} = -a$, and of $\sqrt{-b} = -b$, and $-a \times -b = a\,b$; therefore $a\,b$ is the square of $\sqrt{-a} \times \sqrt{-b}$, and consequently the square root of $a\,b$, or $\pm\sqrt{a\,b} =$ the product of $\sqrt{-a} \times \sqrt{-b}$."

If Mr. Henry O—y's statement be orthodox, the following deduction must of necessity be true:— Multiply $+a$ by $+b$. The square of a is a^2, and that of b is b^2, and $a^2 \times b^2 = a^2\,b^2$; therefore $a^2\,b^2$ is the square of $a \times b$, and consequently the square root of $a^2\,b^2$, or $+\sqrt{a^2\,b^2}$, or $\pm\,a\,b$, is the product of $+a \times +b$!!!

So, Mr. Henry O—y, you denominate this a demonstration! If it be so, it must be an Irish one; for, in plain English, it is no demonstration at all.

With regard to Mr. Ford's proof, he certainly takes for granted that $\sqrt{-1} \times \sqrt{-1} = -1$. Euler asserts the same, (Art. 146, p. 63, vol. i.) without giving an absolute demonstration for it. Indeed, to prove that $-a \times -b = +a\,b$, cannot be rigidly done without the assistance of auxiliary quantities. Euler attempts it, (Art. 33, p. 11, vol. i.); his proof, however, is any thing but satisfactory. The English Editor, in the note at the bottom of the page, has given a strict demonstration of it, but not without the assistance of positive quantities. If such aid be requisite in proving that $-a \times -b = +a\,b$, it could hardly be expected, without similar assistance, that we could prove $\sqrt{-a} \times \sqrt{-b} = -a\,b$, and that $-\sqrt{-a} \times -\sqrt{-b} = -\sqrt{a\,b}$, or that $+\sqrt{-a} \times -\sqrt{-b}$, or $-\sqrt{-a} \times +\sqrt{-b} = +\sqrt{a\,b}$.

Before entering upon the proof of the above propositions, it will be necessary first to explain how imaginary or impossible quantities are generated.

Suppose $x^2 - 2\,b\,x + c^2 = o$;

solving this quadratic equation in the usual way, we obtain

$x = b \pm \sqrt{(b^2 - c^2)}$.

Now suppose $c^2 > b^2$, and let $c^2 - b^2 = a$ $\therefore b^2 - c^2 = -a$; hence the two roots of the equation will be $b \pm \sqrt{-a}$; and as both roots involve an impossible quantity, the two values of x are said to be imaginary, or impossible.

First, suppose $x = b + \sqrt{-a}$

$$\begin{array}{r} b+\sqrt{-a} \\ b+\sqrt{-a} \\ \hline x^2 = b^2 + 2\,b\sqrt{-a}\;\Theta\;a. \end{array}$$

We have prefixed the ambiguous sym-

bol Θ to the product of $\sqrt{-a}\times\sqrt{-a}$, as it yet remains to be proved whether Θ is $+$ or $-$, or if it may answer to either $+$ or -1.

$-2\,b\,x=(b+\sqrt{-a})\times-2\,b=-2\,b^2-2\,b\sqrt{-a}$;

hence, $x^2-2\,b\,x+c^2=o=-b^2+c^2\Theta a=o$.

First, Suppose Θ is positive, then $-b^2+c^2+a=o$; and restoring the value of a, we have $-b^2+c^2+c^2-b^2=o$.·. $c^2=b^2$, which is contrary to hypothesis; hence, $\sqrt{-a}\times\sqrt{-a}$ cannot be $+a$.

Second, Suppose Θ is -1, then $-b^2+c^2-a=o$; and restoring the value of $-a$, then $-b^2+c^2-b^2+c^2=o$; and this conclusion perfectly agrees with the conditions of the given equation .·. $\sqrt{-a}\times\sqrt{-a}$ must of necessity be $-a$.

By taking the second value of x, viz. $b-\sqrt{-a}$, it may be demonstrated exactly in the same way that $-\sqrt{-a}\times-\sqrt{-a}=-a$.

Again, by resuming the equation $x^2-2\,b\,x+c^2=o$.·. $2\,b\,x-x^2=c^2$, or $x\times(2\,b-x)=c^2$. But $x=b\pm\sqrt{(b^2-c^2)}$; and supposing, as before, that $c^2>b^2$, and their difference $=a$.·. $x=b\pm\sqrt{-a}$, hence $2\,b-x=b\mp\sqrt{-a}$. It therefore follows, that $(b+\sqrt{-a})\times(b-\sqrt{-a})$ or $(b-\sqrt{-a})\times(b+\sqrt{-a})$, must produce $+c^2$.

$$\begin{array}{l} b+\sqrt{-a} \\ b-\sqrt{-a} \\ \hline b^2+b\sqrt{-a} \\ \quad -b\sqrt{-a}\;\Theta\, a \\ \hline b^2 \qquad\quad \Theta\, a=c^2; \end{array}$$

and supposing Θ is $-$, we have $b^2-a=c^2$; and restoring the value of $-a$, then $b^2+b^2-c^2=c^2$, or $b^2=c^2$, which is contrary to supposition. But taking Θ as $+$, then $b^2+c^2-b^2=c^2$, which answers the conditions of the given equation, .·. $+\sqrt{-a}\times-\sqrt{-a}$ must be $+a$.

Exactly in the same way it may be demonstrated that $-\sqrt{-a}\times+\sqrt{-a}=+a$.

Having now proved that $\sqrt{-a}\times\sqrt{-a}=-a$, and $-\sqrt{a}\times-\sqrt{-a}=-a$; also that $+\sqrt{-a}\times-\sqrt{-a}$, or $-\sqrt{-a}\times+\sqrt{-a}=+a$; and when $a=1$, all this must be true. .·. $\sqrt{-a}\times\sqrt{-b}=\sqrt{a}\times\sqrt{b}\times\sqrt{-1}\times\sqrt{-1}=\sqrt{a\,b}\times-1=-\sqrt{a\,b}$; also, $-\sqrt{-a}\times-\sqrt{-b}=-\sqrt{(a\times-1)}\times-\sqrt{(b\times-1)}=+\sqrt{a\,b}\times\sqrt{-1}\times\sqrt{-1}=+\sqrt{a\,b}\times-1=-\sqrt{a\,b}$, and $+-\sqrt{-a}\times-\sqrt{-b}=+\sqrt{(a\times-1)}\times-\sqrt{b}\times-1=-\sqrt{a\,b}\times\sqrt{-1}\times\sqrt{-1}=-\sqrt{a\,b}\times-1=+\sqrt{a\,b}$. Lastly, $-\sqrt{-a}\times+\sqrt{-b}=-\sqrt{(a\times-1)}\times+\sqrt{(b\times-1)}=-\sqrt{a\,b}\times\sqrt{-1}\times\sqrt{-1}=-\sqrt{a\,b}\times-1=+\sqrt{a\,b}$.

If the reader be not acquainted with quadratics, the following demonstration may be more easily understood:—

Let $\sqrt{(b-c)}$ be multiplied by $\sqrt{(b-c)}$. $\sqrt{(b-c)}\times\sqrt{(b-c)}=\sqrt{((b-c)\times(b-c))}=\sqrt{(b^2-2b\,c+c^2)}$. Now, the sq. root of $b^2-2\,b\,c+c^2$ is $b-c$, or $c-b$; for either of them being squared will produce $b^2-2\,b\,c+c^2$; that is, if it were simply required to extract the square root of $b^2-2\,b\,c+c^2$, we would say it was $\pm(b-c)$, or $b-c$ and $c-b$, because we are not supposed to know whether $b^2-2\,b\,c+c^2$ was produced from the multiplication of $(b-c)\times(b-c)$, or $(c-b)\times(c-b)$. But this ambiguity does not take place in the question proposed; for it is $\sqrt{(b-c)}$ that is to be multiplied by $\sqrt{(b-c,)}$ and not $\sqrt{(c-b)}\times\sqrt{(c-b)}$; therefore, according to that restriction, the root must be $b-c$.

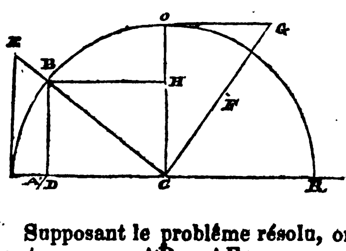
Now suppose c is greater than b, and let $b-c=-a$; then, as $b-c$ is the square root of $b^2-2\,b\,c+c^2$.·. $-a$ must be the root of $\sqrt{-a}\times\sqrt{-a}$. In a similar manner all the other cases of the proposition may be demonstrated.

William Russell.

ALGEBRAIC SOLUTION OF THE GEOMETRICAL PROBLEM, (No. 194, p. 296.)

A l'Editeur du Mechanic's Magazine.

Monsieur,—Dans le No. 194 de votre excellent journal, vous avez proposé le problème suivant:—Déterminer géométriquement sur le demi cercle, l'arc dont le cosinus égale la tangente. En voici la solution.



Supposant le problème résolu, on a tang. arc AB = AE = cos. arc AB = DC, soient le rayon AC $=a$, BD = sin. arc AB $=x$, et AE = DC $=y$.

On a

1o. $DC : DB = AC : AE$,
ou $y : x = a : y$,
donc $y^2 = ax$.
2o. $\overline{DC}^2 + \overline{BD}^2 = \overline{BC}^2$;
ou $y^2 + x^2 = a^2$.

Substituant dans la seconde équation la valeur de y^2 tirée de la première, il vient

$$x^2 + ax = a^2.$$

Pour résoudre cette équation, il faut compléter le quarré du premier membre, en mettant $\frac{1}{4}a^2$, ce qui donne,

$$x^2 + ax + \frac{1}{4}a^2 = a^2 + \frac{1}{4}a^2.$$

La racine quarrée du premier membre est $x + \frac{1}{2}a$. On a par conséquent,

$$x + \frac{1}{2}a = \sqrt{a^2 + \frac{1}{4}a^2};$$

et finalement,

$$x = -\frac{1}{2}a + \sqrt{a^2 + \frac{1}{4}a^2}.$$

Pour construire cette expression, il faut tirer le rayon CO perpendiculaire au diamètre AR, mener $OG = \frac{1}{2}a$ perpendiculaire à OC, et tirer CG.

On a $CG = \sqrt{\overline{OC}^2 + \overline{OG}^2} = \sqrt{a^2 + \frac{1}{4}a^2}$.

Si l'on prend ensuite sur CG, la partie

$$FG = \frac{1}{2}a, \text{ il reste}$$

$$CF = \sqrt{a^2 + \frac{1}{4}a^2} - \frac{1}{2}a.$$

CF étant portée en H, par le point H, on ménera HB parallèle à AC, et l'arc AB sera l'arc demandé.

On voit qu'il faut, pour la solution, diviser la rayon OC *en moyenne et extrême raison*. Comme j'ai trouvé une nouvelle solution de ce dernier problême, je vous l'enverrai dans une autre lettre.

F.

INQUIRIES,

Which we have been requested to submit by our Correspondents.

For the best liquid for mixing with stucco, for giving a fine polish to the surface of engraved cards, such as have of late become so fashionable. By "A Country Engraver and Printer."

For a rose-coloured stain, for paper. By "A Crippled Mechanic and Constant Reader."

For the best method of removing spots from highly polished steel, occasioned by damp. By "A Subscriber at Manchester."

For the best manner of putting canvas upon frames, *perfectly tight*, similar to the canvas used by artists to paint upon. By "J. P."

NOTICES TO CORRESPONDENTS.

J. M. M. S. Yes.

S. P. W. is recommended to consult Nos. 51, 52, 53, and 55.

Our thanks are due to N. H. The cause is partly as he has guessed.

We expect shortly the additional information sought after by W. G. A. S.

We have been expecting for some time the continuation of Mr. Dakin's paper.

F. F. L. S. would have done better to send us the pamphlet of which he speaks. We should like to see it.

Communications received from A Pedestrian — S. C. — F.—A Constant Reader—Rus Astro—Tim Bobbin—H. O.—J. R. Y.—Horace Saul—G.— J. J. —Kandatus—H. O.

ERRATA—p. 83, col. 1, l. 43, for "59" read S G. l. 44, for "9" read G. p. 95, col. 2, l. 2 from the bottom, for "AB. BD." read AD. BD. p. 96, col. 1, l. 26, for "2 A" read ^{2}A. l. 30, for "4 A—cotan. 2=1" read ^{4}A—cotan^2.=1."

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

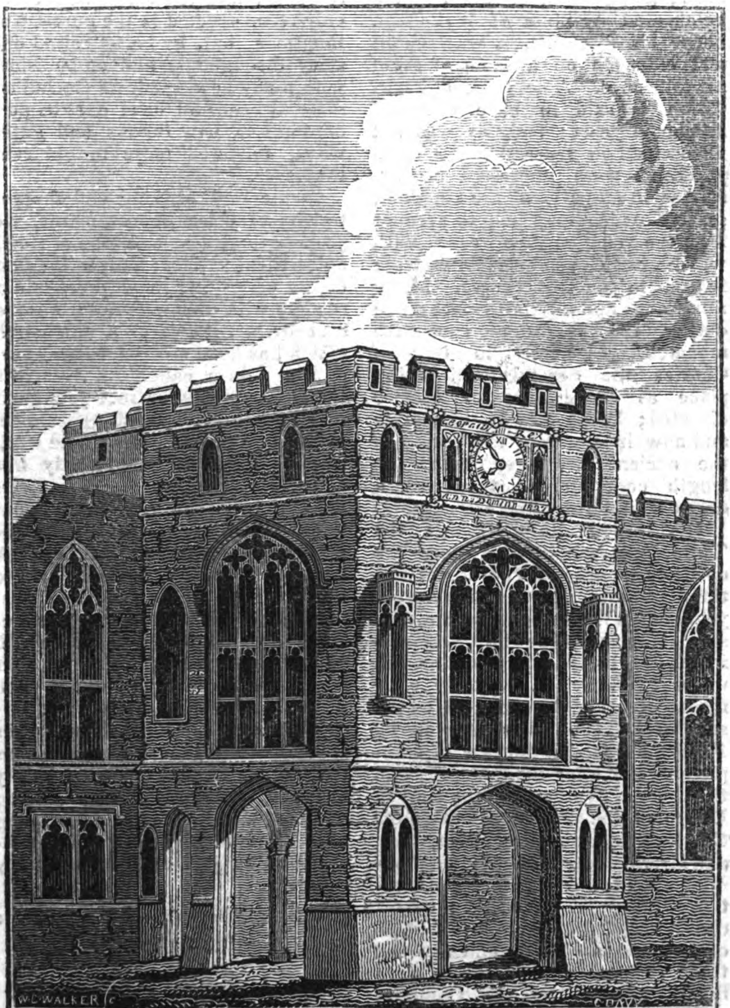
No. 211.] SATURDAY, SEPTEMBER 8, 1827. [Price 3d.

"Windsor the next (where Mars with Venus dwells—
Beauty with Strength) above the valley swells!

* * * * * * *

———A nobler weight no mountain bears,
But Atlas only, who supports the spheres."—Denham.

NEW PORCH, ST. GEORGE'S HALL, WINDSOR CASTLE.



IMPROVEMENTS AT WINDSOR CASTLE.

(From the communications, chiefly, of Mr. Davy.)

WINDSOR CASTLE is supposed to have been founded by William the Conqueror; and as early as the times of the Henrys and Edwards, had become a favourite residence of the Kings of England. Here the puissant Edward the Third was born; and by him, or rather by the celebrated William of Wykeham, under his direction, it was rebuilt and enlarged on a scale of great magnificence. The work of renovation is said to have occupied seventeen years; and, as was not uncommon in those despotic days, workmen were impressed for the service in all parts of the kingdom, (a fact which may help to account for the comparative ease with which most stupendous fabrics were reared in ancient times). Many alterations and additions were made during the reigns of successive monarchs, especially in that of Charles the Second: but taking place as convenience or caprice dictated; being now in one style and now in another; the beauty of the ancient structure became at length completely lost amidst a crowd of unsightly excrescences.

His late Majesty, George the Third, did much to restore the castle to its original character; but the illness which clouded the closing years of his life suspended for a considerable time the improvements which had been happily commenced under his auspices. Shortly after the accession of the present King, a sum of 300,000*l.* was granted by Parliament for the purpose of completely renovating the building; and the Duke of Wellington, the Earl of Liverpool, the Earl of Aberdeen, Sir Charles Long (now Lord Farnham), and Mr. Baring, were appointed Commissioners to superintend the execution of the work. Several of the most distinguished architects offered plans of the necessary improvements; but those of Mr. Jeffry Wyatville were finally adopted by the Commissioners, with the approbation of his Majesty—a preference which the style of the works, as far as yet executed, appears to us to have amply justified.

Not more than about two years have elapsed since the execution of these improvements was commenced; and already it seems as if an entirely new structure had been reared on the site of the ancient castle. All the incongruous appendages by which it was disfigured have been removed, and the whole edifice not only reconstructed in the purest Gothic taste, but, by being raised one story throughout, and embellished with many new windows (including some as beautiful oriel ones as perhaps exist), new towers and gateways, rendered more magnificent than ever.

Of the most striking and characteristic of these improvements, we propose to give a succession of views and critical notices; and, as the first of the series, we now present our readers with a view (drawn on the spot by Mr. Davy) of a new porch which has been erected to that part of the palace called St. George's Hall. A pretty correct judgment may be formed, from this specimen, of the style in which the whole work is executing. It is perfectly free of meretricious ornament—projects boldly, in broad and harmonious masses—and groups well with the adjacent parts of the building. A fastidious eye may perhaps object to the canopied niches, as being disproportionately small; but this defect—if defect it be—is one which you do not at least discover till after you have been wonderfully well pleased with the *tout ensemble.*

The bastion-like form of the piers is particularly judicious—giving, as it does, an air of peculiar stability to the structure, and almost inducing an impression that one is surveying a building which has actually subsisted in its present form for many centuries.

(To be continued in our next, or the ensuing Number.)

NARRATIVE OF THE ERECTION OF THE MENAI BRIDGE.

(*Continued from page* 106.)

Of the Iron Frames, to which the Suspension Chains are fastened.

In order to form a permanent seat, grasp, or hold for the iron frames, to which the lower or extreme ends of the suspension chains were to be made fast, three oblique cavities or openings were made, of a circular form, about six feet diameter, by blasting, in a natural body of rock, on the Anglesea side, leaving a considerable width of rock for the suspension chains. These excavations were carried down like an inclined plane, to the depth of twenty yards.

This being accomplished, a connecting avenue, chamber, or cavern, was formed, horizontally, at the bottom of the cavities, sufficiently capacious for the workmen to fix the iron frames (composed principally of flat cast iron plates), which were afterwards ingrafted, as it were, into the natural rock, so as to bid defiance to any stress that might bear upon them, and to be immoveable, until the whole mass of solid rock itself gives way. This cavern can now be entered, from a passage bored purposely through the same rock, below the level of the road-way. A similar mode of proceeding was adopted on the Carnarvonshire side; but as the rock was situated at a greater distance from the bed of the river than that on the Anglesea side, and it was also necessary to cut through a considerable bank of earth, it turned out an undertaking of immense labour, and took up a considerable time. This accounts for the disproportion apparent in the catenary or chord-line of the suspension chains.

The suspension chains, which are made exclusively of wrought iron, being firmly secured, and made fast to the iron frames before mentioned, the chain-bars, each ten feet in length, were then laid down, by placing five together (equivalent to one breadth of chain), and carried on, by consecutive lengths, joined by flat iron plates and bolts, to the apex of the suspension piers—supported underneath, all the way up, by a frame-work of strong timber—the upper end of the chain resting on the cast iron saddles which had been placed there to receive them. The reader will bear in mind, that at this period the suspension chains were carried no further from their fastenings in the rock on each side than the top of the suspension piers, leaving the chain disjunct, with an open space intervening between the two suspending piers, for the curved part of the chain; which in reality is the actual line of suspension, on which hangs the whole weight of the road way, or any additional weight added thereto, by loaded waggons, heavy droves of cattle, &c. passing over it.

It now becomes necessary to explain how the open space between the two opposite ends of the chain was filled up. But first, it must be premised, that the part of the chain on the Carnarvonshire side, was afterwards lengthened, by adding additional chain bars, from the apex of the suspending pier, until it reached down perpendicularly nearly to high-water mark; whereas, the part of the chain on the Anglesea side extended no further than the apex of the suspension pier.

On Tuesday, the 26th of April, 1825, the first chain (*i. e.* the curved part thereof) of this stupendous work was thrown over the Straits of Menai; the day was calm and highly propitious.

An immense concourse of persons, of all ranks, began to assemble on the Anglesea and Carnarvonshire shores, about 12 o'clock at noon, to witness a scene which our ancestors had never contemplated. Mr. Telford attended, to see this part of his grand scheme effected. Precisely at half-past two o'clock, it being then about half-flood tide, the raft, which was 450 feet long and 6 feet wide (prepared for the occasion), stationed on the Carnarvon side, which supported the part of the chain intended to be drawn over, began to move gradually from its moorings, towed by four boats to the centre of the river, between the two grand piers; when the raft was brought to its ultimate situation,

it was made fast to several buoys, anchored in the channel for that purpose. The whole of this arduous process was accomplished in twenty-five minutes. The part of the chain, pending from the apex of the suspension pier, on the Carnarvon side, down nearly to high water-mark, was then made fast by a bolt, to the part of the chain lying on the raft; which operation was completed in ten minutes. The next process was fastening the other extremity of the chain, still lying on the raft, to two blocks of immense size and power, for the purpose of hoisting it up to its intended station—the apex of the suspension pier on the Anglesea side; the tension of the chain, at this time, was forty tons. When the blocks were made secure to the chain, (each comprising 25 ton weight of iron,) two capstans, and also two preventive capstans, commenced working; each capstan being propelled by 32 men. To preserve an equal force and tension in the rotatory evolutions of the two principal capstans, two fifers played several enlivening tunes, to keep the workmen regular in their steps; for which purpose they had been previously trained. At this critical moment, the attention of every one present seemed rivetted to the novel spectacle now presented to their anxious view; the chain rose majestically, and the gratifying sight was enjoyed by all present in "breathless silence." At ten minutes before 5 o'clock, the final bolt was fixed, which completed the whole line of chain; and the auspicious event was hailed by the hearty acclamations of the numerous spectators; which had a most delightful effect, from the reiteration of sound caused by the reverberation of the rocks on the opposite banks of the river. Not the least accident, delay, or failure, occurred in any department, during the whole operation; which does infinite credit to every individual engaged in this grand work.

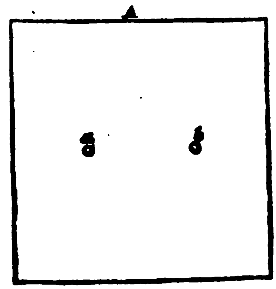
T. B.

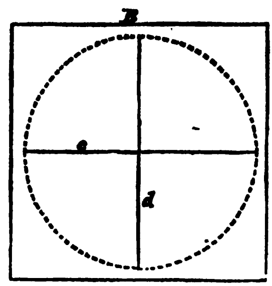
(To be continued in our next.)

MR. JOPLING'S SEPTENARY SYSTEM OF GENERATING LINES.

Sir,—In my last paper, (p. 36, vol. vii.) I gave a description of the *First* and *Second Cases* of Motion in the *Third* Division of the Septenary System of Generating Lines; and I beg, without farther introduction, to describe the

Third Case.





The plane B may now be supposed to be placed upon the plane A; and the right line C moved against the pole *a*, while the right line *d* is moved against the pole *b*.

If the pencil be fixed at the crossing of the two directing right lines *c* and *d*, on the plane B, it will describe a circle on the plane A. The diameter of the circle will be equal to the distance between the poles *a* and *b*, if the directing right lines are at right angles.

If the pencil be fixed in any position on the circumference of the dotted circle, *or line of the cusps*, on the plane B, it will describe the cardioid or heart.

If the pencil be adjusted to any position between *the line of the cusps* and the crossing of the directing

right lines *c* and *d*, it will describe a line with a *node* or *loop*. The nearer the pencil is fixed to the line of the cusps, the less the loop will be; and the nearer it is placed to the centre, or crossing of the directing right lines, the larger; until at length it is lost, when both parts of the line become equal and circular.

The diameter of the cardioid, measuring from the cusp to the opposite side, is twice the diameter of the circle generated.

The radius of the line of the cusps is equal to the distance between the poles, when the regulating right lines are at right angles.

If the pencil be placed in different positions beyond the line of cusps, it will first describe a series of inflected lines, or lines with two points of contrary flexure. The inflection of these lines is the greatest, the nearer the pencil is placed to the line of the cusps; and as it is placed farther off, the inflection becomes less and less, until it vanishes, and the lines become oblate, or flattened, and without any point of contrary flexure.

As the pencil is farther removed from the line of the cusps, the oblate lines become less and less flat, or, in other words, will the more nearly approach to the form of a circle; but here, as in the *Second Case*, if the plane were continually extended, and the pencil continually removed from the line of the cusps, the true circle could never by that means be obtained.

At any point at the same distance from the crossing of the directing right lines, whether within or beyond the line of the cusps, the same curve will be drawn; but every different point will give a line in a different position.

When the directing right lines are at right angles with each other, the lines described are the least that can be produced with any given distance between the poles *a* and *b*. If the angle of the crossing be varied, though the distance between the poles remain the same, the magnitude of the lines will be increased; and the greater the variation, the greater the increase.

This circumstance, so far as it respects the drawing of a portion of a large circle, on the principles of the cyclograph or arcograph, is well known.

The order of the variation in the curves will more clearly appear thus:—

First, A finite circle.
Second, Nodated lines.
Third, A cuspidated line, or the cardioid.
Fourth, Inflected lines.
Fifth, Oblate lines.
Sixth, Approximating to an infinite circle.

In the *Second Case*, between the finite circle and the line of the cusps, and between the line of the cusps and the infinite circle, the lines are of the same character; that is, on both sides they are ellipses. But in this case they are very different; those within having nodes, and those beyond being inflected and oblate.

With this circumstance I was for some time much perplexed, and considered that there was a want of perfection in the laws of generating lines; for if I wished to draw an oblate line very near to the form of a finite circle, I could not by these principles do so. Ultimately, however, I discovered, that in a case in another division of the system, the above order is just reversed—being as follows:

First, A finite circle.
Second, Oblate lines.
Third, Inflected lines.
Fourth, A cuspidated line, or the cardioid.
Fifth, Nodated lines.
Sixth, Approximating to an infinite circle.

Thus, that which by one principle belongs to an inaccessible, an infinite law, is by another principle brought to a finite law, and *vice versâ*. And it may be remarked, the reverse of the latter order contains no other variety; as if all that were required of it was to make up the apparent deficiency of the former.

General Remarks on the Third Division.

By the principles of the *Second Case*, the circle is produced in one

revolution of the plane; but by the principles of the *Third Case*, the circle is produced in half a revolution of the plane. Or if at the same time two pencils be placed, one in the centre of each plane, while the one on A describes the circle on B, the one on B will mark two revolutions round a circle of the same radius on A.

The line of the cusps in the *Third Case* is double the diameter of the line of the cusps in the *Second Case;* the distance between the poles being the same in both cases.

The lines produced by the *First Case* of motion are uniformly symmetrical.

In the *Second Case*, the lines are either uniformly symmetrical, as the circle and the right lines; or respectively symmetrical, as the ellipses. In the ellipse, when one-fourth of the line is drawn, all the variation of curvature in that figure is produced.

In the *Third Case*, one line only —the circle—is uniformly symmetrical; but all others, namely, the nodated, cuspidated, inflected, and oblate lines, are in two parts respectively symmetrical.

Mr. Addison, in the Spectator, says, "The soul, considered with its Creator, is like one of those mathematical lines that may draw nearer to another for all eternity without a possibility of touching it;" but, perhaps, the second case in this division will convey a more perfect idea of man, both in his present and future state, in reference to his Maker. Thus,

First. God said, let us make man in our *image.*

The express *image* of an infinite circle is a finite one.

Second. Man in his present state must be considered a *finite* being.

All the lines produced within the line of the cusps belong to the *finite* law.

Third. Before the soul of man can be said to make perpetual progress towards the perfection of its nature, he must have passed the *grave.*

Before the law of variation *can* be said to approximate towards an infinite circle, the describing point must have passed the *line of the cusps*—a fit expression for *death!*

Fourth. The soul of man is not *changed* by death, only the law of his state—"*this* MORTAL *must put on* IMMORTALITY."

The lines on each side of the line of the cusps are *precisely of the same character*—only the law of variation within is *finite*, that beyond is *infinite*.

Having it in contemplation to publish an instrument and complete description of my method of drawing spiral lines, illustrated by a large engraving of the most difficult volute, I must, for the present, decline entering upon that application of this division.* Your readers will, however, I trust, be able, from what I have now said of the third division, to form some idea of the way by which I describe the nature of the motions and their effects in forty-two cases in the seven divisions of the system, on which I shall now make some general observations.

The point, pole, or centre—the right line and the circular line—are unquestionably the foundation and extremes of all other generated lines. The effects of these three simple principles, in their most simple combinations, are all included in the septenary system. All the lines that can be produced may be classed under two general heads. The first are finite, or such as return into themselves; the second are infinite,†

---

* Last year Mr. Alderson laid his instrument for drawing arcs of large circles before the Society of Arts; and previously to doing so, he showed it to me, when I informed him that I could, with such an instrument, draw spirals and other curves: but he states in his report, that it will draw spirals; as if he had himself actually discovered and drawn such lines with it. The fact however is, that he had not then drawn any such lines; and I think I may venture to say, that he does not yet know how to produce them.

† Mr. Addison again says, "In our speculations of eternity, we consider the time which is present to us as the middle,

or such as only a portion can be drawn, however far produced: and under each general head there are,

First, Lines uniformly symmetrical;

Second, Lines respectively symmetrical, or repetends; and,

Third, Dissymmetrical lines, or such as have no repetition of the the law of curvature.

Again, under the two last description of lines are,

Nodated,
Cuspidated,
Inflected, and
Oblate lines.

A line, whether finite, or infinite, may have one, two, three, or any greater number of nodes, cusps, points of contrary flexure, or oblate or flattened parts.*

The several cases of motion in the whole system are so arranged, that a gradual connexion may be traced from the first to the last.

Perhaps it is worthy of remark here, as a proof of the system being perfect, that by the principles of the *first* and *seventh* division, triangular figures may be generated, but not by any of the intermediate divisions. The triangular figures produced by the first are of every possible form; those produced by the last are always equilateral. In some divisions the *lines of the cusps*, which divide the tracer plane, or that to which the pencil or describing point is fixed, into different fields, are straight; in others, circular, elliptic, parabolic, &c. Some cases have but one *line of the cusps*, others two, &c.

It is now two thousand years since Nicomedes discovered the conchoid, and its mode of generation; but, as far as I can ascertain, it does not appear that either he, or any other person since his time, ever had any idea of applying those principles to regulate the motion of a plane, or of reversing that motion, or of tracing the gradual connexion between the cuspidated conchoid and the cissoid; which latter curve was discovered by Diocles, one thousand four hundred years ago.

The celebrated Dr. Barrow, the preceptor of Sir Isaac Newton, is said to have racked his fancy for every kind of motion by which curved lines could be generated. Whether he discovered any thing new, I am not aware; but, if I may judge of what Sir Isaac has said of the generation of curved lines, they were rather extensions and combinations of principles previously discovered, than any new principles of generation by simple continuous motion. Dr. Robinson says, that the evolute, the reverse of the cycloid, which was discovered by Huygens, had escaped Dr. Barrow. Huygens produced his curve by the unwinding of a string from a cylinder; and Dr. R. continues the idea, and observes, that a straight ruler, or inflexible line, may be substituted for the flexible line, the string; and I had followed up the train of thought previously to knowing of either, and can say, that to the straight ruler a *plane* may be added.

The subject of generating curved lines has, you will perceive, been deemed of great importance by geometricians and mathematicians for many ages; indeed, in some instances, the honour of discovering curves has been contested. And *why*, let Dr. Barrow, who was sen-

---

which divides the whole line into two equal parts." Thus, eternity is like those infinite lines of which only a middle portion can be produced.

* The path of the moon, as described by the apparatus invented by Mr. Ferguson, is an oblate epicycloid in twenty-six parts, respectively symmetrical, or having thirteen flattened but not inflected parts. The path of the earth, described by the same apparatus is a circle: but the orbit of the earth is an ellipse; therefore Mr. F.'s apparatus does not describe the actual track of either the earth or moon in their orbits round the sun. The principal object, however, in the exhibition of Mr. F.'s apparatus by lecturers on astronomy is, perhaps, to show that a line may be flattened without being inflected. And thus two lines may be always concave the same way, yet cross each other's path. In this way a circle may cross the path of an ellipse four times; which is, perhaps, the most simple illustration of the circumstance intended to be explained by Mr. F.'s apparatus.

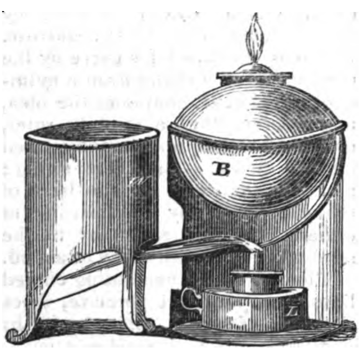
sible of the great pleasure derivable from invention, answer, by an inquiry he asks, "Do any man's children so much please him as these creatures of his brain?" The Dr., however, was not perhaps a married man.

In conclusion, I beg to say that, perhaps, I may from time to time give, through periodical publications, general, or occasionally, particular explanations of some portions of the septenary system; but my greatest ambition is to publish all that I know on this subject, illustrated by such a number of correct engravings, on a scale of sufficient magnitude, as, by almost mere inspection, at once to convey an idea of the causes and effects, and of the gradual connexion and harmony of the whole.

I am, dear Sir,
Your's, &c. &c.
JOSEPH JOPLING.

P. S. I beg your acceptance of the accompanying pamphlet, which contains my first ideas of this system previously to having any instrument made. Perhaps the work may now be considered rather as a matter of curiosity, as I am not aware of any person having understood it before they had it explained by an apparatus.

WATER BOILING APPARATUS.



Sir,—On passing the shop of Mr. Marriott, on Ludgate-hill, the other day, I observed the apparatus of your correspondent, S. W. Wansbrough, (see Mech. Mag. Vol. VII. page 233,) in the window, under the title of "a *Patent** self-acting Blow Pipe for expeditiously Boiling Water." The tin pot, in which the water is boiled, is not like that described by T. W. W., but is of the common construction; the flame of the blow-pipe is directed against the side of the vessel, about half way down. If those who constructed these machines expect to boil all the water in the vessel by the application of heat (however intense) at the place above mentioned, they are deceived. They may boil all the water *above* the point at which the heat is applied—but below that, ebullition will not descend; of this fact, I have lately had several proofs.

To effect the boiling of the whole of the water contained in the vessel, I would recommend the bottom of it to be made slanting, and mounted on three legs, as in the preceding diagram, where W is the vessel containing the water; L the lamp; and B the blow-pipe; the flame of which is directed against the bottom of the tin pot, and would speedily boil the whole of its contents.

Your's respectfully,
W. BADDELEY.

MACHINES FOR COMPRESSING EARTH IN MOULDS.

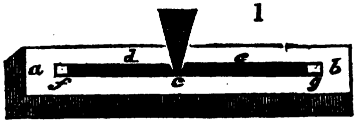
Mr. Editor,—I agree with Mr. Pergo, in his assertions in No. 197, page 345, that none of the proposed machines for compressing clay in moulds, as given in your useful publication, are so convenient or so well adapted as the common screw-press, which I advise Mr. Loudon to try; but, at the same time, any of those machines or mills which make oil cakes would effectually answer the purpose. The modern ones go with a lever, or screw, or both; but the old ones go with a bittle, or ram, as the pile driver. In my travels lately, I saw one of a different nature, or rather superior shape to any of the others, the form of which is represented by the following sketch; and

* Mark *the prostitution of the word!*

would, I think, for Mr. Loudon's purpose, be preferable to any other, if he wanted to make any considerable quantity; not otherwise.

About six or eight yards of an oak tree, hewed square, had a channel cut in it within a foot at each end of its whole length, in depth only the side of the cube required, as *a b;* within this channel two

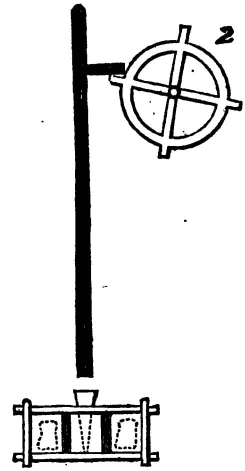
1



small oak beams, *d e*, were laid, meeting in the middle, excepting only a space for the point edge of the wedge, as at *c*: the substance to be pressed was put in, one at each end, in the spaces *f* and *g;* the bittle, or ram, was then made to fall on the wedge from the necessary perpendicular height, which, of course, pushes the horizontal beams with very great force against the substance to be pressed in the said cavities, *f g*. The superiority of this over any other, I conceive to be principally for the two following reasons: first, its greater power; secondly, the choice of forming ten or twelve at a time, or as many as can be placed on each side the wedge in the channel, having a wooden or iron partition between each; as the same force is required for one, as for all the trough, bed, or channel, would contain. This contrivance is in use by a very ingenious gentleman in Montreal, whose active mind has had much display there in a variety of ways.

The machine used in Flanders for this purpose, is a vertical pole raised by a wheel with four projecting spokes in it, worked by a horse. Two bags are put in the frame box; the wedge acts between them in a partition, which of course is of a lighter shape and make altogether, as in fig. 2, and is, I believe, the oldest of all shapes. The English oil-press often unites the screw *with* the lever as before said.

It must be observed in fig. 1, that a cap or strong lid must be hooked on with square hoops or other



security, as in the manner of a steam trough: for the machine, as now used, the upper side is *uncovered.*

I shall be happy to be of the least service to the inquirers through your useful work, and remain,

Your's,
VIATOR.

N. B. As the machine was only intended for *two* moulds or cakes, at the *beginning* of the pressure, the two active beams *d e* were not horizontal, but raised in the middle in the form of a pair of rafters of a very flat roof, so that several blows took place before they became horizontal; this can be done, of course, only when but two moulds are used at a time, but perhaps the pressure is greater in proportion: the wedge is of no use till they are horizontal.

ON HEAT, AND ITS ECONOMICAL CONVERSION INTO STEAM.

BY MR. W. GILLMAN, CIVIL ENGINEER.

Notwithstanding the patient investigations of the most distinguished philosophers through so many ages, it has not yet been determined whether heat be a subtle fluid, or whether its phenomena are occa-

sioned by tremulous or vibratory motion; and so far as experience and experiment have gone, it certainly must be acknowledged that neither of the prevailing hypotheses as to the cause of heat is satisfactory or conclusive.

In stating my views relative to the best mode of applying heat to the purposes of evaporating fluids, or the production of steam, it is not necessary to advert to the subject farther than to observe that heat will be considered *material;* the gaseous fluids as its reservoirs; and the atmosphere the grand store, whence it is drawn and deposited in a concentrated and visible state in the shape of fire.

The animal, vegetable, and mineral kingdoms, furnish us abundantly with inflammable substances, which are chiefly composed of inflammable gases that have acquired solidity from deprivation of heat. These require a greater or a less degree of temperature to set their gases free, to enable them to ignite nearly in proportion to their several densities and purities. Thus coal, which is of greater density than many woods, is not so readily inflamed, because it requires greater temperature to overcome the attraction of cohesion, or, in other words, to detach the atoms; and wood, again, less than fat or oily substances, on the same principle. Nature, indeed, presents few, if any, substances so detached but that a sufficient number of atoms are in aggregation to form a particle, whose cohesive attraction effectually protects its gases from being charged by solar or the natural heat of the atmosphere, without the intervention of some chemical operation. Were their particles in general to be held so loosely as to become aëriform, as readily as fluids evaporate, the whole face of nature would be destroyed; for two gases having an affinity for each other, could not exist in a gaseous form in any quantity, subject momentarily to ignition from ten thousand different causes. Were the atoms so easily disengaged, there is every reason to suppose that combustion, once commenced, could never be staid until either the oxygen of the atmosphere or the inflammable matter were annihilated. Hence the probable cause, why one gas only exists in our atmosphere, possessing a great and general affinity to enter into combination with inflammable substances, and why it is requisite that these substances should be rendered so difficult of separation.

The great affinity of oxygen, or, in other words, the great attractive force with which oxygen combines with other gases, is necessarily qualified by admixture with another gas—*azote*, which refuses all combination except under very particular circumstances. I have said it is *necessarily qualified*, because its great power of supporting combustion would be productive, in some measure, of the like effect to that which would arise from the atoms of inflammable gases becoming aëriform at low temperatures, were it not restrained by the interposition of the atoms of azote till the moment of union; these materially retarding the velocity of combustion that would otherwise ensue.

In the operation of combustion, the solidified gases are recharged with heat; when they again assume an aëriform state, and immediately unite with the oxygen of the atmosphere with great rapidity. The result of this union is a deposit of the heat or the matter of fire previously contained in the oxygen, and which is now set free by the diminished capacity arising from the change which that gas has undergone; for we have a right to assume, from the solidity of the inflammable substances, that they contain no more heat than other bodies of the same density.

That the quantity of heat contained in aëriform fluids must be prodigious, may be inferred from the following calculation; which I propose some day to follow up by a series of experiments.

A cubic foot of water weighs 1000 ounces, and is composed of oxygen and hydrogen nearly in the following proportions: 1355 cubic feet of hydrogen, and 659 cubic

feet of oxygen; collectively amounting to 2014 cubical feet of gas. Now, a cubic foot of water formed by the combustion of these quantities of gas flies off in the state of vapour of as much elasticity as steam produced at 212 degrees, (if not greater); and we know that a cubic foot evaporated at that temperature under the like pressure, will fill a space equal to about 1800 times its original bulk, which is nearly three times the bulk of the oxygen, and wanting only 214 feet of that of the gases before forming the compound. Yet the 1800 feet of vapour is at least of the temperature of 212 deg.; and we also know, that were the heat it contains in the concentrated state of water, it would be sensible to upwards of 900 degrees—and this independent of the vast heat we derive from it in the shape of fire. Now all this, it would appear, must be derived from the oxygen, in consequence of the hydrogen being rendered aëriform, or being set at liberty by the deposited heat alone in the operation of combustion; though previously to its entering into union, the oxygen might only have exhibited the common temperature of the atmosphere.

This is a most curious and wonderful phenomenon; provided my calculations are correct, which I think they must be admitted to be, if heat be matter, and derived from the concentration of elastic fluids—a point which I apprehend is capable of demonstration.

The intensity of fire depends on the rapidity with which combustion is carried on, and the means of escape which the heat possesses after evolution. In parlour and common culinary fires, combustion is comparatively though desirably slow; which arises from the draught not being made to pass wholly through the fire to the flue, by reason of the separation between the flue and fire-grate. These fires are generally made in grates which are formed of good conducting materials, and have large sections of surface exposed to radiation and other means of escape; so that the heat never accumulates to an intense degree, and seldom beyond what is requisite to carry on a very moderate combustion.

To obtain intensity of heat, it is indispensable that fire should be encircled with the worst possible conductors suitable to the purpose, and arranged in such forms as to preserve the heat most effectually from escape, that the purpose for which it is designed will admit. Thus shielded, the temperature will go on increasing, until the power arising from intensity is sufficient to overcome the resistance opposed to its passage, and then it will make its way by every means that affords an outlet, in quantities that will in the aggregate equal the power of production; when production and expenditure being in equilibrium, accumulation ceases. The acquired temperature, however, is still continued, provided the fire is adequately supplied with inflammable matter, and that the heat is not extracted by other means.

Thus we have, in what are termed hollow fires, a most intense degree of heat; sufficient, indeed, to bring a large block of iron called a bloom to almost a melting temperature in a very short space of time. The great concentration of heat in these fires proceeds from the large quantity of unignited coals with which they are backed; this backing being a very bad conductor of heat. Any escape by the aperture on each side, for the purpose of introducing the metal to be heated, is likewise prevented by such expedients as circumstances will admit. Hence it is manifest that the intensity of heat in these cases is occasioned by accumulation, which is effected by the negative assistance of time, by continual production, and by preservation from escape.

Whoever has had the opportunity of seeing the kilns for burning all kinds of pottery or bricks, the furnaces of glass-houses, and the like, during the time of working, must have observed the great intensity of heat that all the parts subject to the action of the fire—even in the very

flues, to the utmost extent visible to the eye—have acquired. But in this, as in the preceding case, the great degree of temperature is occasioned by accumulation; the ware, and all the exposed surfaces, being of the worst kind of conductors. Being *permanent*, also, during the process, the means afforded for escape, except by the air and vapours passing from the fire into the atmosphere, are extremely small. The air and vapours too are unequal to the task, until the intensity has attained such a degree as to load them to an extent that, in conjunction with the small means of escape through the ware, they carry off the heat equal to the power of production; when that equilibrium at which nature strives in all her operations is effected, and no further intensity can be acquired. Were the substance of the ware capable of transmitting heat as speedily as metals, the heat would be absorbed immediately in the neighbourhood of its evolution; and therefore it is to the badness of the conductors that we are indebted for the accumulation, and for the means by which that part of the ware situated the most distant from the fire is burnt through; the air and vapours being made instrumental in carrying the heat forward.

In applying heat to the purposes of evaporation, or the production of steam, the effect is very different to the above. Every means are taken to absorb it with all possible speed; all the surfaces exposed are of the very best kind of conductors; and the fluid receiving the heat is transitory; even the very particles are ever changing place with each other. Hence no accumulation is observed; and, though such concentration is absolutely necessary in many operations, it will be seen in the sequel that it is of but little importance in this.

When we observe a fire of great intensity, our *feelings* suggest that it would be desirable to plunge tubes for the purpose of generating steam into the midst of it, in expectation that the production would be wonderfully accelerated; but though such an idea is very natural, yet if we reason on the consequences that must follow from such a mode of application, an unfavourable conclusion would, I believe, soon be drawn as to its propriety. If a cold poker be thrust into a fire, it may be observed, that however bright those coals immediately in contact might have previously been, they become instantly blackened by its introduction, arising from the iron absorbing the heat so rapidly, by reason of the great difference of temperature; and, though the body of metal is small, some considerable time intervenes before the fuel acquires its wonted brightness, and the combustion can proceed as rapidly as it did before. The same effect is occasioned by the bloom when introduced into the hollow fire before noticed; notwithstanding the intensity of which, were these blooms to be successively changed, as soon as they had produced this first impression on the fire, the whole store of heat would be quickly absorbed, and combustion speedily destroyed altogether. For though it is an uncontrovertible fact, that the greater the difference of temperature between the heat and the body to be heated, the greater and more speedily will be the absorption, yet it is limited in the mode of application. Bodies in *absolute contact* with fire, will not admit of such difference to any great extent, without destroying combustion, as may be inferred by the effect produced by the poker and blooms; a fact, which is farther illustrated by the effect produced on simply throwing water on a fire—this being nothing more than the most complete application of contact, and combustion being here destroyed merely by the excess of the difference of temperature. The great quantity of heat absorbed in its evaporation, enables a small quantity of water to produce great effect.

This is sufficient to show the impropriety of conducting water through tubes *enveloped in fire;* as it is manifest that it must pass very slowly, and ought to be introduced at a considerable temperature; otherwise the fuel immediately in contact

will become black, and its combustion be retarded or cease altogether, when, in consequence of its being an extremely bad conductor, the water will receive comparatively very little heat from the surrounding stove. Hence it would appear, that, notwithstanding the great body of heat enveloping a tube or tubes, they must chiefly derive their supply from the combustion of the fuel immediately in contact, and that the supply is limited to the quantity evolved by such combustion; for, as has been repeatedly shown, if more heat be taken up in a given time, than is produced within the same space of time, combustion is retarded, and sooner or later completely destroyed.

Considering, therefore, the great destruction of fuel that attends this mode of application, and that the chief of the available heat rises from the body of the fire with the air and vapours in the shape of flame, &c., which can never be brought into action without all the additional appendages necessary to a complete boiler or generator, its inefficiency seems abundantly manifest.

(To be continued.)

ASTRONOMICAL INQUIRIES.

Sir,—In the "Memoirs of the Astronomical Society of London," vol. i. p. 164, Professor Littrow, of Vienna, has stated that Mr. Gauss shows clearly that the mass of Jupiter, given by La Place, is wrong by more than a tenth part.

The perturbations of Pallas, produced by Jupiter, amount to several degrees, and consequently afford a very certain means of determining the mass of the latter.

Now, one second variation in the elongation of Jupiter's fourth satellite will cause a difference of $\frac{1}{163}$ part of the mass of this planet; and one second variation in the elongation of the seventh satellite of Saturn will cause a difference equal to the $\frac{1}{171}$st part of the attractive power of Saturn.

Example for Jupiter's Fourth Satellite.

′	″				
8	15	..	1173294	..	$\frac{1}{1073\cdot5335}$
8	16	..	1175665	..	$\frac{1}{1067\cdot0533}$
8	17	..	1178035	..	$\frac{1}{1060\cdot6254}$

Saturn's Seventh Satellite.

′	″				
8	32	..	2225500	..	$\frac{1}{3554\cdot476}$
8	33	..	2229847	..	$\frac{1}{3533\cdot730}$
8	34	..	2234194	..	$\frac{1}{3513\cdot146}$
8	35	..	2238540	..	$\frac{1}{3492\cdot722}$

The first column contains the elongation of the satellites; the middle column, their distances in miles from their respective primaries; and the latter column, the mass or attractive power of each planet—that of the sun being equal to unity.

Hence it appears, that the attractive powers of these planets may be more correctly obtained from the effects of their attractions on the planets situated nearest them, particularly the planet Jupiter, in consequence of his magnitude, and distance from the minor planets.

It appears from the above statement, that the elongation of Jupiter's fourth satellite, usually stated at 8 minutes 16 seconds, is in error about 16½ seconds. Consequently, if M. Gauss is correct in his deductions, there is little chance of arriving at any great degree of accuracy in the attractive powers of the planets, as computed from the observed elongations of their satellites. The observations of their diameters must be subject to greater uncertainty, on account of the irradiation of light.

Astronomical instruments have, however, acquired at this time a degree of perfection far superior to what they possessed a few years since; and of course the observations made with them are arrived at a similar point in the scale of improvement.

It would therefore be advantageous to the science of astronomy, if the observations of astronomers of the present day were more introduced to public notice, in order that

the diameters of the planets and the elongations of their satellites might be corrected, and consequently the magnitudes and attractive powers of the planets belonging to our system; as different authors have been much at variance in this respect.

An answer to the following queries, by any of your correspondents, would oblige,

Sir, your obedient Servant,

J. UTTING.

1st. Would not the diameters of such planets as have satellites be more correctly ascertained from the time occupied in the transit, or occultation, of their satellites?

2nd. Does an acceleration exist in the motion of light, or is its motion uniform, in emanating from its source to any given distance therefrom?

3rd. Has the velocity of light been computed from an occultation, or transit, of the satellites of Saturn or Uranus? It has been asserted by astronomers, that eclipses of the latter would take place about the year 1799, or in 1818.

4th. Has it been distinctly ascertained that the motion of the satellites of Uranus are retrograde, or is it only an optical illusion?

OPERA DANCERS BAD WALKERS.

The walk of opera dancers is neither natural nor beautiful; but the surprising exercises which they perform, give to the joints of the foot a freedom of motion almost like that of the hand. We have seen the dancers, in their morning exercises, stand for twenty minutes on the extremities of their toes; after which, the effort is to bend the inner ankle down to the floor, in preparation for the Bolero step. By such unnatural postures and exercises, the foot is made unfit for walking, as may be observed in any of the retired dancers and old figurantes. By standing so much upon the toes, the human foot is converted to something more resembling that of a quadruped, where the heel never reaches the ground, and where the paw is nothing more than the phalanges of the toes.—*Treatise on Animal Mechanics; Library of Useful Knowledge.*

CENTRE OF GRAVITY.

A great inventor (in his own estimation) published that he had solved the important problem of walking on the water, and he invited the public to witness his first essay. He stepped boldly on the wave, equipped in a pair of bulky cork boots: but it soon appeared that he had not pondered sufficiently on the subjects of the centre of gravity and of floatation; for, in the next instant, all that was to be seen of him was a pair of legs sticking out of the water. He was picked up by help of hand, and his genius both cooled and schooled by the event. In like manner, some soldiers once finding a few cork *jackets* among old military stores, determined to try them: but mistaking the shoulder straps for lower fastenings, they put them on as *drawers;* and on their plunging in, with the hope of being able to sit pleasantly on the water, their heavy heads went down, and they were nearly drowned.

EFFECTUAL MEANS OF DESTROYING MOLES, GRUBS, AND SNAILS.

The smell of garlic is so offensive to moles, that, to get rid of them, nothing more is necessary than to introduce into their subterraneous walks a few heads of the same. It has also been employed with success against grubs and snails.

JAMES COX.

DIRECTIONS FOR MAKING A LIQUID FOR STAINING WOOD, BONE, OR IVORY, OF DIFFERENT COLOURS.

Put some strong white wine vinegar in a glass vessel, and add to it the filings of copper, with some Roman vitriol, rock alum, and verdigrise, and leave it for infusion for seven days; then boil it; and by putting into it bone, ivory, or wood, it will

penetrate into it, and give it a green colour. For a red colour, use Brazil wood; for blue, indigo; yellow, French berries, &c. &c.

A VERY GOOD VARNISH FOR FURNITURE.

To one ounce of virgin's white wax, add eight parts of petroleum: lay a slight coat on the piece of furniture with a badger's brush. The oil will then evaporate, and leave a thin coat of wax, which should afterwards be polished with a coarse woollen brush.

COMPOSITION FOR A CEMENT TO RESIST FIRE AND WATER.

Take half a pint of milk, and mix with it an equal quantity of vinegar, so as to coagulate the milk; separate the curds from the whey, and mix the latter with the whites of four or five eggs, after beating them well up: the mixture of these two substances being complete, add sifted quick lime, and make the whole into the consistence of putty. If this be applied carefully (and properly dried) to broken bodies or fissures of any kind, it resists fire and water.

PARALLEL LINES.

Sir,—As the subject of parallel straight lines is still labouring under some degree of obscurity, any attempt to place the subject in its proper light, if consistent with geometrical principles, ought to be appreciated. In accordance with this sentiment, I have sent you the following demonstration; and if it is deemed by you worthy of consideration, I shall be happy to see it inserted in your valuable Magazine.

The converse of every geometrical proposition is always true, insomuch that some geometricians have considered the demonstrations of the converse of an established proposition unnecessary and superfluous. With this remark, I beg to propose that the enunciation of the 17th prop. of 1st book of Euclid be thus expressed.—If a straight line intersect two other straight lines that meet in a point, the two internal angles are less than two right angles; therefore conversely, if the internal angles that one straight line makes with two other straight lines, be together less than two right angles, these lines meet in a point. These angles must obviously be equal to, less, or greater, than two right angles: if less, then they must, as before proved, meet on that side of the cutting line on which they are; but if greater, they will be less than two right angles on the opposite side, and consequently must meet on that side. But if they meet when the angles are either greater or less than two right angles, they must be parallel when they are equal to two right angles.

KANDATUS.

Remarque sur la Solution de G. S. p. 111.

Cette solution est appuyée sur l'équation.

$$AD \times BD = \overline{AB}^2.$$

Faisons AB$=a$, et BD$=x$, nous avons

$$(a \times x)x = a^2$$
$$\text{ou } x^2 \times ax = a^2.$$

On en tire $x = -\frac{1}{2}a \times \sqrt{a_2 \times \frac{1}{4}a^2}$ valeur que j'ai trouvée pour le sinus de l'arc demandé.

Mais, dans la construction de G. S. les deux triangles rectangles B D E, A G F, étant parfaitement égaux, on a BD$=$GA, et par conséquent,

$$GA = -\frac{1}{2}a \times \sqrt{a^2 \times \frac{1}{4}a^2}.$$

Ce qui fait voir la concordance de ma solution avec celle de G. S. puisqu'elles donnent le même résultat pour le sinus de l'arc dont la tangente égale le cosinus.

Si $a=1$, la formule devient

$$x = -\tfrac{1}{2} \times \tfrac{1}{2}\sqrt{5}$$

Valeur trouvée par G. S. et Mr. M'Kinnon.

F.

NEW PATENTS.

EDWARD DODD, of Berwick-street, London, musical instrument maker, for improvements on piano-fortes. Dated

July 25, 1827. *(Six months to enrol specification.)*

THOMAS PEEK, of St. John-street, Clerkenwell, London, engineer, for the construction of a new engine worked by steam, which he intends to denominate a revolving steam engine. Dated Aug. 1, 1827. *(Six months.)*

WILLIAM PARKINSON, of Barton, Lincolnshire, gent., and SAMUEL CROSLEY, of Cottage-lane, City-road, Middlesex, gas apparatus manufacturer, for an improved method of constructing and working an engine for producing power and motion. Dated August 1, 1827. *(Six months.)*

LIONEL LUKIN, of Lewisham, Kent, for improvements in the manufacture of collars for draught and carriage horses, and saddles for draught, carriage, and saddle horses, partly communicated by a foreigner. Dated August 1, 1827. *(Six months.)*

EUGINE DU MESUIL, of Soho-square, London, Esq., for an improvement or improvements on, or additions to, stringed musical instruments. Dated August 1, 1827. *(Six months.)*

ANTHONY SCOTT, of Southwark Pottery, Durham, earthenware manufacturer, for an apparatus for preventing the boilers of steam-engines, and other similar vessels of capacity, becoming foul, and for cleaning such vessels when they become foul. Dated August 4, 1827. *(Two months.)*

PETER BURT, of Waterloo-place, Limehouse, mathematical instrument maker, for an improved steam-engine. Dated August 4, 1827. *(Six months.)*

JOHN UNDERHILL, of Parkfield Ironworks, Staffordshire, iron-master, for improvements in machinery or apparatus, for passing boats, and other floating bodies, from a higher to a lower, or a lower to a higher level, with little or no loss of water; and which improvements are also applicable to the raising or lowering of weights on land. Dated August 13, 1827. *(Six months.)*

THOMAS BREIDENBACK, of Birmingham, merchant, for improvements on bedsteads; and in making, manufacturing, or forming articles, to be applied to or used in various ways with bedsteads, from a material or materials hitherto unused for such purposes. Dated Aug. 13, 1827. *(Six months.)*

WILLIAM DICKINSON, of Bridge-street, Southwark, tin-plate merchant, for an improved buoyant bed or mattrass. Dated August 13, 1827. *(Six months.)*

WILLIAM ALEXIS JARRIN, of New Bond-street, London, Italian confectioner, for improvements in apparatus for cooling liquids. Dated August 13, 1827. *(Two months.)*

WILLIAM CHAPMAN, of Newcastle-upon-Tyne, civil engineer, for a certain improvement or improvements in the construction of waggons that have to travel on railways or on tramways. Dated August 14, 1827. *(Two months.)*

HENRY PINKINS, of Philadelphia, gent., for an improved method or apparatus for generating gas to be applied to lights and other purposes. Dated Aug. 15, 1827. *(Six months.)*

WILLIAM SPONG, of Aylesford, Kent, gent., for diminishing friction in wheel-carriages, water-wheels, and other rotatory parts of machinery. Dated Aug. 16, 1827. *(Six months.)*

LEMUEL WELLMAN WRIGHT, of Mansfield-street, Borough-road, Surrey, engineer, for improvements in the construction of cranes. Dated August 17, 1827. *(Six months.)*

THE SAME, for improvements in machinery for cutting tobacco. Dated August 21, 1827. *(Six months.)*

NOTICES TO CORRESPONDENTS.

The great expedition with which our sheets are necessarily printed, rendering it impossible to have the proofs of the articles submitted to their respective authors, and seldom allowing of more than one revision by the editor; it is particularly requested that our mathematical correspondents, when making use of algebraic language (errors in which are the most frequent), will be as clear and distinct as possible, and set down the characters in such relative positions as it is intended they should appear in print. A correspondent has pointed out, as an instance (in addition to those furnished by our own pages) of the importance of minute attention to the printing of algebraical expressions, a remarkable erratum in the Treatise on Mechanical Powers of the Society for Diffusing Useful Knowledge, where (3^{n-1}) is printed for $(3^n - 1)$. The value of the former expression is 81, of the latter 242.

Communications received from Maturus—A Constant Reader—K. N. N. T. —J. Sterer—F.—Mr. Woollgar — Mr. Goulson—Abel Dabbler— H. O.—W. P. —F. F. L. S.—E. Newnham—H. J.

Mr. Deykes's Reply to Mr. Dousberry, in our next.

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Mechanics' Magazine,

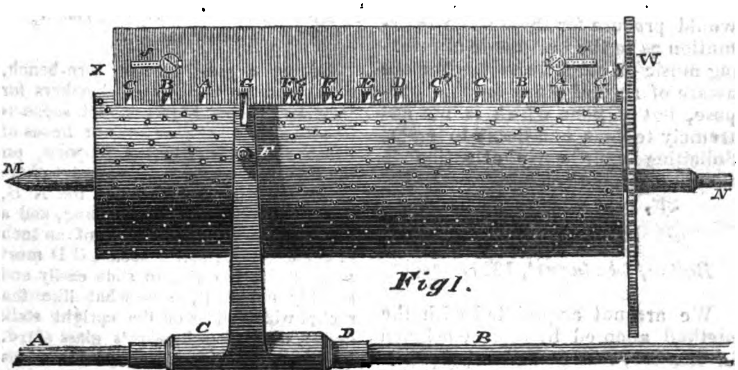
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

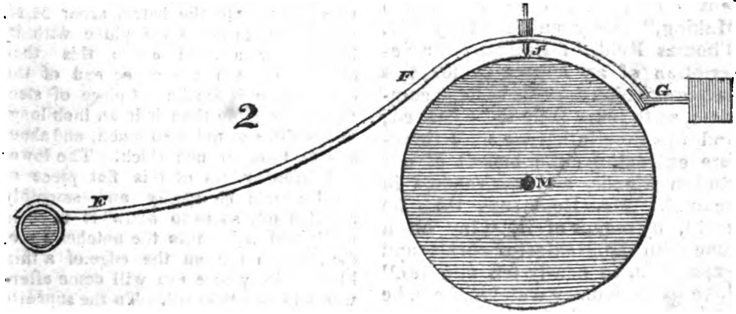
No. 212.] SATURDAY, SEPTEMBER 15, 1827. [Price 3*d*.

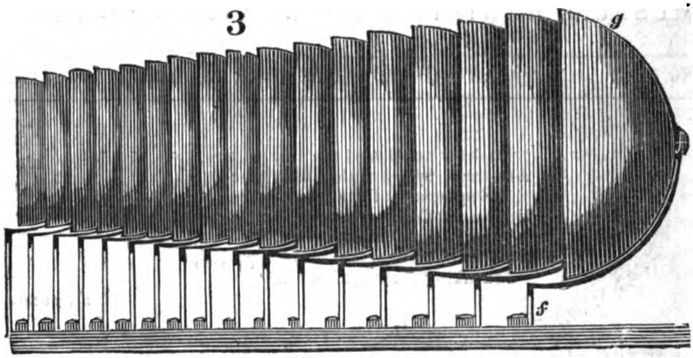
" Orpheus could lead the savage race,
And trees, uprooted, left their place,
Sequacious of the lyre :
But bright Cecilia raised the wonder higher,
When to her Organ vocal breath was given ;
An angel heard, and straight appeared,
Mistaking earth for heaven."

Dryden.

APPARATUS FOR PRICKING MUSIC ON CLOCK BARRELS.







Sir,—You would greatly oblige several horologists in this part of the country, and, I am convinced, your ingenious readers generally, if you would procure for them some information as to the best mode of pricking music on clock barrels. We are aware of several plans for this purpose, but of none which is not extremely tedious and liable to error. Soliciting your early attention to this request, we remain,

Sir, your obliged Servants,
M. D.
A. A. F.

Bolton, 3*d August*, 1827.

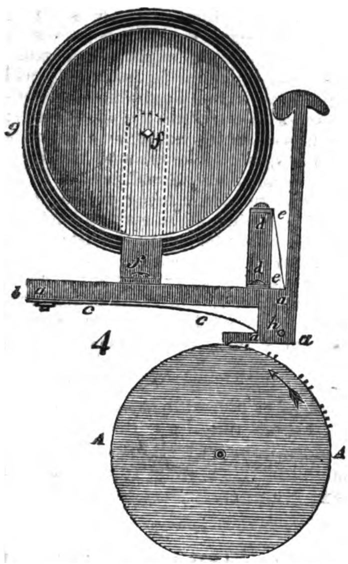
We are not acquainted with the method adopted by those workmen in London, who practise the pricking of music on clock barrels; and should be happy if any of them would favour us with an account of it, that we might make it more generally known.

We find, however, in the excellent "Treatise on Clock and Watch Making," lately published by Mr. Thomas Reid, of Edinburgh, a description of an apparatus for this purpose, which appears to us so complete, as to leave little to be desired; and this description we shall therefore extract, for the benefit of our Bolton friends, and our readers in general. Mr. Reid says that he could, by means of it, "lay on a tune with the greatest accuracy and expedition, in nearly ten minutes." Like other country watchmakers, he had experienced the imperfections of the ordinary methods of pricking, and was hence led to the invention of the improved apparatus, which he thus describes:—

Mr Reid's Apparatus for Pricking Clock Barrels.

Having a good strong turn-bench, such as those used by clockmakers for their larger sort of work, let supports be attached to the standards or heads of it, on each side; to the supports, on the side nearest the workmen, let there be fixed a straight cylindrical rod A B, fig. 1, about 10 or 12 inches long, and a quarter or even three-tenths of an inch in diameter. A spring socket C D must be made for this rod, to slide easily and steadily along it, somewhat like the socket which slides on the upright stalk or rod of a watchmaker's glass stand. In the thick and strong part of this socket, E, is fixed a steel arm F, bent into a curve, which lies over and above the music barrel, when in the turn-bench, as shown in fig. 2, at E F G. The steel rod A B may be placed at pleasure at any distance from the barrel, about an inch or rather more, and should stand parallel to the barrel arbor M N, and nearly in the same plane with it, but rather a little above this than otherwise. On the outer end of the curved arm is fixed a flat piece of steel G, a little more than half an inch long, in breadth not quite so much, and about one tenth of an inch thick. The lower and front edges of this flat piece of steel should be neatly and smoothly rounded off, so as to allow it to come easily and freely into the notches A B C, &c., which are on the edge of a thin brass scale, whose use will come afterwards to be explained. To the supports attached to the turn-bench heads, and on the opposite side to that where the

round steel rod is placed, let there be fixed a slip of brass X Y, about ten or



twelve inches long, an inch and a half broad, and nearly a tenth of an inch thick, the inner edge of which must be made to stand parallel with the barrel, and the flat side to stand nearly in a plane between the upper surface of the barrel and its centre; the edge being placed so as to stand clear of the tops of the teeth of a high numbered wheel W, screwed on to the end of the barrel. Near the ends of this slip of brass, slits are made, through which screws *e e* pass, which fix it to the upper side of the supports; the slits serving to allow it to be shoved a little occasionally lengthwise, when required. On the upper side of the slip of brass, is fixed another, but not quite so thick, the length being about that of the barrel, and breadth one inch and three quarters. On the inner edge of this are made as many notches A B C, &c. as there are hammers, bells, or notes, to be used in the tune or tunes to be marked on the barrel. These notches are equidistant, and the middle of them should correspond to the middle or line of the hammer-tails; their width being such as to admit the flat steel piece G on the end of the curved arm EFG, fig. 2; the depth of them cut on the edge of the brass should be about one quarter of an inch. The edge of this piece of brass, or music-scale, as it may be called, must also stand parallel with the barrel, and at a little distance from it, not nearer than three-tenths of an inch, so that the flat steel piece on the end of the curved arm may have room to get in a little way, and to pass through at the same time to a certain degree of depth. On the upper side of this brass slip, the letters of the scale of music, or gamut, are marked to these notches, which correspond with the hammer-tails and hammers intended to strike on the bells the notes so marked; but in an inverted order to the usual way in which they are marked in the scales of music—the lower notes being on the right-hand side, and, as they rise, going to the left. This is done to suit the way in which the bells are commonly, though not necessarily, placed in music clocks (see fig. 3); it is in the power of a clockmaker, of any ingenuity, to contrive the barrel to turn any way he thinks proper, and place the bells to stand in the order of the music-scale, if there is any advantage to be derived from it. In the curved arm E F G, fig. 2, is fixed a punch *f*, having a very fine and sharp conical point, at the distance of four inches or so from the centre of the sliding socket, and not quite an inch from the outer end of the flat steel piece; the punch, when applied to the barrel, should stand upright, and directly over the centre of it.

This apparatus being all adjusted as now directed, it is evident, that when the curved arm is raised up a little way, the socket can then be made to slide easily along the steel rod; and, by this means, bring the outer end of the flat steel piece very readily into any notch required; and the point of the pencil is brought, at the same time, with the greatest precision, to the place of the note on the barrel, leaving the flat steel piece, for the time, in the notch. The point of the punch touching or resting on the barrel, a stroke from a very small hammer on the top of it will cause the point to make a pretty deep mark or conical hole on the surface of the barrel.

It now remains to be shown how *the time or the lengths of the different notes are determined.*

Long or slow, short or quick notes—such as the minim and demi-semiquaver—are not well suited to bell-music, and of course are seldom introduced into tunes chosen for it. The *crotchet, quaver,* and *semiquaver,* form the greatest part of the composition; the minim and demi-semiquaver may, however, be brought in at some parts.

It may be unnecessary to state what is pretty generally known, the proportional value of the notes to one another; suffice it to say, that a minim is equal to two crotchets, a crotchet to two quavers, a quaver to two semiquavers, and a semiquaver to two demi-semiquavers.

The time in which the barrel turns, after striking or lifting a hammer tail, to strike any note on a bell, must be in the same proportion with the notes, according to their respective characters. Let a wheel of 250 teeth, for example, be fixed on the end of the barrel, and let both be placed in the turn-bench, with the apparatus which has been described. To the turn-bench is now attached a steel or brass spring, having a knee or bending at one end, so that it may fall into the spaces of the wheel teeth. Suppose the tune to be laid on the barrel contains 20 bars of 3 crotchets each, being 60 crotchets in all; if 250, he number of the wheel teeth, be divided by 60, the number of the crotchets, we shall have 4 for the quotient, and 10 for the remainder; showing that we may take 4 teeth spaces for every crotchet; 10, the remaining part of it, serving as a run for locking, and the other part for a run at unlocking, for a tune to be played.

Now, as a crotchet is equal to four spaces, a quaver must be equal to two, and a semiquaver equal to one. Suppose the first note in the tune proposed is F, (see fig. 1) the curved arm is brought to the left hand, and the flat steel piece put into that notch; the punch is then made to mark the barrel; and this being a semiquaver, or the fourth part of a crotchet, the spring index is shifted into the next space of the wheel teeth, and the curved arm moved to the next note, which is G on the left hand, and the flat steel piece being put into the notch corresponding to G, the punch is made to mark it on the barrel. This being a semiquaver also, the spring is shifted into the next space, and the curved arm moved to note A on the left; the steel piece is put into the corresponding notch, and the punch marks this on the barrel. A is here equal to a quaver and a half; therefore the spring index must be moved over three, or into the third space, and the curved arm moved to the next note, being B, on the left hand; the steel piece being put into this notch, the note is marked on the barrel; and as it is a semiquaver, one space is taken for it, and the arm moved to G. This being marked, and as it is a quaver, two spaces are taken, and so on. When crotchets are marked, four spaces are taken after marking them.

In the tune which we have just exemplified, nine bells or notes are all that are required; and three more, or a dozen, would give such a compass as to take in almost any tune that might be required.

In place of the spring index, it would be better to have a single-threaded endless screw to work into the wheel teeth; one turn of which would be equal to a tooth or space. The arbor of the screw being squared at one end, and a small handle for turning it being put on, there would be less danger of making mistakes with the screw than with the index. On the arbor of the screw there might also be put a hand or index, to point to a circular space or dial of eight or ten divisions. This would give room to make *parts* of a turn, where great nicety is wanted.

Mr. Reid proceeds to explain how, after one tune is laid on a barrel, others may be added; but this explanation, as well as some other particulars, we must reserve for our next Number.

ON HEAT, AND ITS ECONOMICAL APPLICATION TO THE CONVERSION OF FLUIDS INTO STEAM.

BY MR. W. GILLMAN, CIVIL ENGINEER.

(*Continued from page* 125.)

Whatever may be the intensity of a fire, or the store accumulated, the available heat is limited to that which is every instant evolved over and above the quantity requisite to supply the deficiency arising from escape by radiation and other means. Now, as so little of the available heat can be collected by tubes arranged in the manner before noticed, and as the chief of such heat rises upwards from the body of the fire, the most effectual means to secure it, for the purpose of heating fluids, is to arrest it in its progress as quickly as possible, by subjecting surfaces of the most suitable form, in the most proper position and of the most proper relative temperature for its absorption, according as it acquires distance from the fire, and becomes weakened by expansion and abstraction. Now this, it is presumed, is accomplished by the principle of application described

and illustrated in Numbers 202 and 203, Vol. VII. of the Mechanics' Magazine.* This mode of arrangement renders the principle of applying heat to surfaces in contact with water, or other fluid, in a proper relative temperature, both simple and effective, whether the application is for the purpose of producing steam of low pressure or generating that of high: for, though the strata of water in the low-pressure boiler may not be separated so completely, nor propelled to the stratum over the fire by the assistance of the feeding pump, as the water in the tubing; yet, from fluids not receiving heat downward but in a very limited degree, and from the tendency of the heated particles upward, through their diminished specific gravity (the chief medium by which heat is conducted throughout the whole body of fluids), the result is quite as perfect.

The next object for consideration is the position of surfaces to which heat is applied, and what form is best. With regard to the first, it need scarcely be observed, that against no surface does the action of heat produce so great an effect as against an horizontal one immediately above; both from the tendency of heat upwards, and the principle on which fluids receive heat. It will be perceived, that due attention has been paid to this in the arrangements before referred to, where the perpendicular surfaces have been reduced as much as possible, and those that are horizontal have been extended as much as is compatible with convenience, or indeed necessary. By this means the heated air and vapours, instead of being conducted in volume as in the usual manner, spread in a thin sheet against such surfaces, immediately on rising from the fire; which brings the particles much sooner into contact, so that there is not time for expansion, and the heat to become latent to such an extent, before it can be abstracted by the fluid, as in the ordinary flue. Besides, in consequence of the current, as it becomes exhausted in acquiring distance from the fire, still sweeping surfaces of a proper relative temperature, it not only has its heat more effectually abstracted, but in a much shorter length of flue, than by any other principle of application.

Surfaces are heated by the particles only that come in contact and impinge against them; therefore the form of surfaces is of very great importance for abstracting heat most effectually. Those that are smooth are by no means the best for the flame and heated air to project against on their immediately rising from the fire, or to sweep against in the flue; for the gaseous carriers, winged with heat, on rising from the fire, only strike at an angle, and that a very acute one, while the current in the flue sweeps along merely in contact, without the power to impinge at all: thus the upper stratum of particles give up their heat by contact alone, and consequently part with it comparatively slowly; and, when exhausted, have not time to sink by their increased specific gravity (arising from loss of heat), so as to effect a change of place, before they have been carried

* Two illustrative forms of construction only are given, these being sufficient to elucidate the principle of action of the boilers and generators. The ascending flues, however, admit of other forms, particularly applicable under different circumstances. Wrought iron tubes and boilers are proposed in the construction of generators for steam vessels, which will render them much lighter than those composed of cast iron; these are arranged in cast iron frames, similar to that of the generator, fig. 3, No. 204, Vol. VII. The ends of the generators are composed of tubes, cast together in thick plates, through which water is made to pass likewise to the boilers (not shown in the illustrative figures); and which preserves them from destruction, at the same time that they are easily detached by unscrewing the bolts, without disturbing the rest of the generator, for cleansing the flues or any other purpose.

It is necessary to notice an oversight in the 3rd figure, No. 204, which may probably have caused some readers to be puzzled, as to *how* the fire was supplied with air. Beneath the fire-place door, there should have been an ash-pit inserted.

over a considerable space by the velocity of the current. Hence the reason why it is found, that when the bottoms of steam boilers are much patched, steam is generated far more freely than before. This is caused by the rough surface affording something for the particles of the upper stratum of the current to impinge against with force, and from the change of place among the particles which such surface must necessarily occasion. We might further illustrate this; but what has been said is considered as sufficient to show that, of all surfaces, those formed by collections of tubes, or small cylindrical boilers, are the most favourable for abstracting heat. The undulating surfaces these present to the flowing current, enable it to strike at considerable angles against the curves successively: for example, the upper stratum impinges against the curve of one tube, whereby it is checked in its progress for a moment; in the mean time the next stratum of particles passes on, and strikes the next tube; and so on through the whole range: thus a tubular surface not only affords means for the particles to impinge against, but likewise causes a sort of revolutionary motion in the current, and brings the particles of the whole sheet into contact in succession.

A boiler or generator, such as before referred to, whose flues are of small depth but of great width, presents the means, in a compact form, of obtaining as much surface with as small a quantity of water, and in as small a space of room, as it is possible, perhaps, to attain. The surfaces ought to be extended until all the heat is abstracted worth collecting; for, though there exists no doubt but that steam may be obtained in sufficient quantity to supply an engine, with a comparatively small quantity of surface, yet this must be effected at the "*expense of fuel;*" and to the endeavour to accomplish this object may be attributed the fact, that so little profit has as yet been achieved by using high-pressure steam in proportion to the fuel expended. The reduction of surface requires that the heat should be applied so much the more intensely; and this occasions a much greater proportion of the heat to be sent up the chimney, more particularly when there are no surfaces of a proper relative temperature to which it can be applied for abstraction after it is in the flues. Besides, in heating water at great degrees of temperature, a much less quantity of heat is absorbed immediately on its rising from the fire, than when the relative difference is much greater; adding greatly to the necessity for extended flues, and to the importance of applying heat on the principle illustrated in former numbers of the Mechanics' Magazine.

I have observed, in a recent communication, that "a considerable quantity of surface will still be necessary to maintain the required supply of steam;" that is, it will still be necessary, consistent with making the most of the fuel. And, I believe, there cannot be two opinions, as far as respects the application of steam power to the propulsion of vessels, which is the most desirable of the two—the saving of a few tons of metal by reduction of surface, or the saving of many tons of fuel in every passage, at least where they are of any extent.

The thickness of metal too, is an object not unworthy of attention; for the greater the distance the heat has to be conducted before it is taken up by the fluid, the more intensely must it be applied to the exterior surface. We have here, therefore, another cause for lessening the facility of absorption, and to send the heat to the flues or chimney. Metal has been used of great thickness, with the notion that it assisted in abstracting the heat, and thereby promoted evaporation,—a notion, probably, suggested by the instantaneous effect produced, when steam is generated by injecting water into chambers either composed of great thickness of metal, or surrounded by it. This arises, however, from the heat accumulated and stored in the mass of metal, rather than from any property it possesses of effecting

a more speedy transfer: for though steam be instantaneously produced, it must be remembered that the metal has been a long time previously acquiring the heat; so that when the water is first injected, the heat is given up, like the momentum stored up in a fly-wheel when a machine needs its assistance. For thick metal may, indeed, be considered to be in effect (at least in this case), what a fly is to machinery —a mere regulator. The fly equalizes, by its momentum, the effect of a power that is desultory in its action; and it is consequently an indispensable appendage to many machines, notwithstanding the loss of power occasioned by its use; but thickness of metal, beyond what security requires, is not indispensable, as fires, with common attention, can be regulated sufficiently without it, and the quantity of heat lost from its transmission being impeded, is in no way compensated by the use of such additional thickness.

(To be concluded in our next.)

NARRATIVE OF THE ERECTION OF THE MENAI BRIDGE.

(*Continued from page* 116.)

From the casting off of the raft (which was mentioned before), to the uniting of the chain, took up two hours and twenty minutes; which appears truly astonishing, when the magnitude of the work is considered, and which could be appreciated by those only who had an opportunity of viewing it,—a work, differing, in sublimity of design, from every other bridge; and which, undeniably, has not its equal in the known world.

Upon the completion of the chain, three of the workmen; viz.—H. Davies, stone-mason; Wm. Williams, labourer; and John Williams, carpenter; had the temerity to pass along the upper surface of the chain, which forms a curvature of 590 feet. The versed sine of the arch is 43 feet. On the termination of the day's proceedings, each workman (about 150 in number) was regaled, by order of the Right Hon. the Parliamentary Commissioners of the Holyhead Road Improvements, with a quart of *cwrw da.*

The other fifteen chains were taken over according to the following dates:—

2d	chain . . .	April 28th
3d	do. . . .	May 7th
4th	do. . . .	— 10th
5th	do. . . .	— 13th
6th	do. . . .	— 14th
7th	do. . . .	— 21st
8th	do. . . .	— 24th
9th	do. . . .	June 4th
10th	do. . . .	— 8th
11th	do. . . .	— 10th
12th	do. . . .	— 11th
13th	do. . . .	— 15th
14th	do. . . .	— 21st
15th	do. . . .	— 28th

On Saturday, July 9th, 1825, the sixteenth, or last, suspension chain was taken over, which completed the entire line of suspension.

The same mechanical process was pursued in taking this chain over as that stated before, only with this difference—the workmen having acquired, by practice, an increased degree of adroitness, this last chain was got over, and the bolt fixed, in one hour and thirty minutes. On fixing the final bolt, a band of music descended from the top of the suspension pier, on the Anglesea side, to a scaffolding erected for the purpose on the centre of the curved part of the chains, and there played the national air of "God Save the King." The workmen were there arranged, and marched (accompanied by the music) in Indian file, on a platform resting on the two lowest centre chains, from the Anglesea to the Carnarvonshire side, along the curvature of the chain, and back again; which had a most picturesque effect from the sea shore. While this was going forward, the St. David steam-packet, of Chester, passed under the chains. This packet had the honour of opening the navigation of the strait, which had been closed from the 21st of April preceding.

The sixteen suspension chains being all adjusted and placed equidistant to each other, the vertical

rods were fastened to them, the lower ends being firmly bolted to the iron sleepers (or transverse road-way bars), each vertical rod and sleeper being placed longitudinally, 5 feet apart. There are 111 sleepers; to each of which are attached transversely four vertical rods, making the whole number of vertical rods in the line of suspension (*i. e.* between the two suspension piers) 444.

The next process was laying the planks down across the sleepers, to form the suspended road-way.

On Saturday, 24th Sept. 1825, at five o'clock, p.m., the first tier of planks on the road-ways were rendered passable for the convenience of the workmen. The road-way consists of two carriage-roads, each 12 feet broad, with a foot-path 4 feet broad in the centre between them, inclosed all the way by an iron railing on each side, to secure passengers from accident; and it also affords personal protection from carriages or horned cattle passing along the road-way.

Three tiers of deal planks form the flooring of the road-way: the lowest tier are 3 inches thick, the second tier 2 inches thick, both laid down longitudinally as the road runs; the third, or upper tier, 2 inches thick, are laid transversely, to the width of 8 feet, with side-guides, made of African oak, to keep the carriage-wheels clear from injuring the vertical rods.

The form of the suspended road-way is somewhat convex, rising gradually from the ends to 3 feet high in the centre; it resembles a kind of eye-brow curve.

On the night previous to opening the bridge, a notice was sent to the ferrymen, that as soon as the mail-coach had passed over the bridge, the ferry-boats were to cease plying, and the ferrymen's services were from that moment no longer required.

Dimensions of the Stone-work

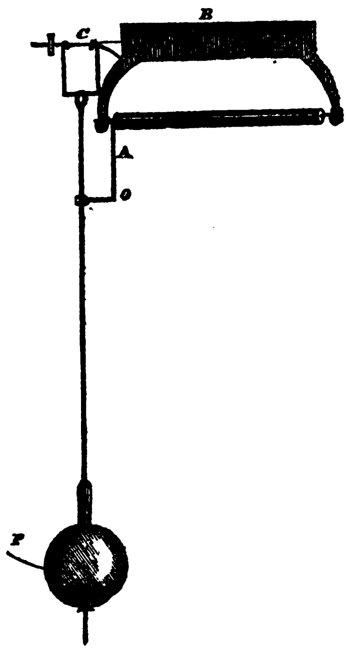
The height of each of the main piers is 100 feet from the high-water line to the level of the road-way. From the main piers to the toll-houses the road falls at the rate of 1 foot in 25.

The arches of the small piers spring at the height of 65 feet above high-water line. The width of each arch is 52 feet 6 inches. Each of the suspension piers rises to the height of 52 feet from the level of the road. The carriage-roads pass through two arches in the suspension piers, of the width of 9 feet, by 15 in height to the spring of the arches.

I am, Sir,
Your obedient Servant,
T. B.

(*To be concluded in our next.*)

QUESTION IN MECHANICS.



Sir,—You will oblige a constant reader, by giving the above sketch a place in your Magazine.

The sketch represents a pendulum 5 feet long, with a weight of 1lb. attached to the ends, suspended from the shaft C and B, to which is attached the arm A, nine inches

long, moved by the oscillation of the pendulum. Now the question I wish to put is, what power will it take to keep the pendulum moving through the arch P of five feet; the power to be applied at O? An answer from some of your intelligent readers will be of great importance, and confer a great obligation on

Your most obedient Servant,

T. C. E.

ON THE MATHEMATICAL LINES USUALLY INSERTED ON THE SECTOR PLAIN SCALE, AND GUNTER'S SCALE.

Your correspondent, "MONAD," having concluded his intelligent papers on the Sector, I take the liberty to offer a few remarks, by way of supplement. Although, as has been observed (p. 311), the elementary figure (p. 189) shows geometrically how the different lines are derived from the circle, yet, in practice, the only safe method of graduating these lines is by a scale of equal parts, from tabular numbers previously calculated. Now, the trigonometrical functions termed sines, tangents, and secants, are exhibited in tables which are everywhere to be met with, and these form the foundation of all the rest. Mr. Ferguson, in his "Mechanical Exercises," has given tables for graduating the whole series of lines, in a form which (with the exception of the dialling-lines) is most convenient for that purpose. These tables are accompanied by very ample explanations, which the student would do well to consult. I propose here to give a synopsis, in an algebraical form, of the values of the divisions on the several lines; reckoning in each case from the beginning, and expressed in terms of the natural or logarithmic sines, tangents, &c. The radius for natural numbers is taken $=1$; for logarithmic numbers $=10$.

1. Chords. 2 sin. $\frac{1}{2}$ a, a being the angle denoted by the proposed division.

2. Rhumbs. Constructed like the preceding, substituting 1 point for $11\frac{1}{4}°$.

3. Inclination of Meridians. $1+$ tan. $(45° \backsim a)$, using the upper sign when a is greater than $45°$.

4. Hours. Constructed like the preceding, substituting 1 hour for $15°$.

5. Latitudes. $\dfrac{2\text{ sin. }a}{\sqrt{(1+\text{sin.}^2 a)}}$

6. Versed sines. 2 log. sec. $\frac{1}{2}$ a.*

7. Meridional Parts. $131{\cdot}93\ n$ (log. cotan. $\frac{1}{2}$ comp. $a - 10$), n being the value of one division on the scale of equal parts which accompanies the meridional line, which value is independent of the other lines on Gunter's scale. On the common two-feet scale, it is about a tenth of an inch.

I have not seen the last formula in any book; it is generally only stated that the meridional parts are *analogous* to the logarithmic tangents of half the complements of the latitudes.

The defect in Ferguson's Tables for the lines of Inc. Meridian Latitudes and Hours, is, that they are calculated to radius $707{\cdot}1$, instead of 1000, as all the others are. He has also omitted to state the method by which he calculated the table of latitudes. The formula given above, though rarely to be met with, is correct: but the following is easier of calculation, and corresponds with the geometrical construction; viz.—Assume an auxiliary angle ϕ, so that tan. $\phi =$ sin. a; then 2 sin. ϕ is the value sought. The angle whose value on the line of latitudes is equal to radius, is $35°.26439$.

"MONAD" observes, that in the practice of dialling, it is better to resort to calculation in setting off the points, than to trust to any scale of lines. I admit that the dialling lines commonly found on scales and sectors are much too small to ensure accuracy; but it must be considered that the calculation of all the hour angles for a large dial is very tedious; and that the angles, when obtained, must be laid down by a

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* This accords with the *line* of V. S. as laid down on Gunter's scale; but not with the *table* given by Hutton and others.

more accurate instrument than a common protractor. I shall therefore point out a method by which the lines on a six-inch sector may be applied to the purpose in question.

In the delineation of a dial, a fundamental right-angled triangle is laid down; one of the legs of which is determined by the line of latitudes, and the hypothenuse is the line of hours. Now, if we suppose a six-inch sector extended till the two lines of tangents form one straight line, it will represent a line of hours of 11·7 inches, each 1-4th of a degree being equal to a minute of time. We have therefore only to ascertain the length of the leg of the triangle corresponding to this hypothenuse; for which purpose I have calculated the following Table, for every 10′ of latitude on the parallel of England.

Latitude.		*Rad.* 1.	*R.* 5·85
°	′		
50	0	1·21624	7·115
	10	810	126
	20	996	137
	30	1·22180	147
	40	363	158
	50	545	169
51	0	726	179
	10	906	190
	20	1·23084	200
	30	262	211
	40	438	221
	50	613	231
52	0	787	241
	10	960	252
	20	1·24132	262
	30	303	272
	40	473	282
	50	641	291
53	0	809	301
	10	975	311
	20	1·25141	321
	30	305	330
	40	468	340
	50	631	349
54	0	792	359
	10	952	368
	20	1·26111	377
	30	269	387
	40	426	396
	50	582	405
55	0	1·26737	7·414
90	0	1·41421	8·273

In the old treatises on mathematical instruments, mention is made of two lines which occupied principal stations on the French sectors—the lines of surfaces and of solids. Whether this practice is continued at the present day, I know not: but since these lines have their utility, a short description of them will not be out of place. They are for the purpose of comparing together the superficies of similar plane figures, and the volumes of similar solids, by means of their corresponding linear dimensions. As the line of lines is delineated from a scale of equal parts—that is, according to the *first* powers of the numbers expressed by the divisions; so the line of surfaces is laid down from a table of square roots, or roots of the *second* powers of numbers; and the line of solids, from a table of cube roots, or roots of the third powers of numbers. The extent of the divisions on each scale is usually from 1 to 64, but the limit is entirely arbitrary.

I wish to impress on the mind of the young draughtsman the great importance of the *scale of equal parts;* and of that of inches, decimally divided, above every other of the kind. A scale of inches divided into tenths, and *subdivided into fiftieths, ought* always to be laid down on the feather-edge of the plotting or protracting scale belonging to a case of instruments. My own experience has shown the superiority of this to every other scale, for the general purposes of mechanical drawing. A twelve-inch scale, in a separate case, is better still than a six-inch one.

I am, &c.

J. W. WOOLLGAR.

47, *Essex Street, Strand,*
August 27, 1827.

P. S. Since writing the above, it has occurred to me, that for the vertical dials, the table ought to give the values for the complements of the latitudes; which defect I shall probably supply in a future communication.

THE NEW ASTRONOMICAL THEORY.

Sir,—The speculation of your correspondent, Mr. Shires, (No. 210,) is so nearly assimilated to Mr. Walker's, that it can hardly be entitled to the distinction of a New Astronomical Theory. Mr. Walker supposes the particles of light which constitute the solar atmosphere, strongly to repel each other; that this property of repulsion is one cause of light being dispersed, or projected in every direction through space; but at the equatorial regions of the sun, the centrifugal force created by his rotation, co-operating with repulsion, produces a more copious emission of the vital ocean, than at the polar regions: the sun revolves on an axis inclined about eight degrees from the plane of the ecliptic; his equatorial, or greatest centrifugal discharge of particles, will, therefore, be nearly confined to the zodiac, or tract of the planets where the greatest supply is required. Supposing the fixed stars to be suns, he supposes that these suns recruit each other, by imbibing, at or near their poles, most of the light that reaches them; for towards their poles the strong attraction of the sun's body overcomes the repulsion of light, being but little accelerated by the centrifugal force; and the light thus absorbed sinks down for the supply of the equatorial regions. But the most beautiful part of his hypothesis is, that it explains the cause of the diurnal motion of the earth, and other planets, which Newton left unaccounted for. In all the different positions in which the earth is situated in respect to the sun during its annual revolution round him, it will be found that more rays fall on the one side of its axis, than on the other; and, the consequence of such an inequality of impulse must be a rotation on its axis; perhaps also its annual revolution round the sun. *(Vide Smith's Panorama of Science and Art, Vol. I. page 536.)*

A similar theory was published by *Miller*, in his *Inquiry into the Cause of Motion* (quarto, pp. 143, London, 1781). He supposes the motion of light, (or particles of fine active matter) to be continually issuing from the bodies of the sun, planets, and fixed stars, in every direction, with great velocity; and that the motion of these elastic particles increases in proportion to their rarity—their velocity being much greater at the orbit of the earth than at their first emission from the sun's surface; and that they continually increase, in proportion as the distance and rarity increase.

It was with a view to the elucidation of these theories that I transmitted you the *second* and *third* queries contained in my last letter; as I am not aware that any acceleration exists in the motion of light, or that its velocity has been ascertained by any other method than that of the eclipses of Jupiter's satellites.

The motions of the planets, however, cannot be accounted for by this theory, only on the principle that the particles of light possess a very great power of repulsion.

The greatest velocity communicated to a body by the rotation of the sun on his axis, is by far too small to produce the required effect. The velocity of the planet Mercury being 24 times greater than that of a point on the sun's equator; it is therefore absolutely impossible that the sun can communicate, by its rotary motion, a degree of impulsion to any particles of matter, or to any medium diffused throughout the solar system, so as to produce the orbicular motions of the planets.

I think, however, after all the theories which have been ushered into the world of late years, there is not one likely to supersede the theory of Newton. These Anti-Newtonians will not admit of the theory of *gravitation;* because, forsooth, they cannot see any connexion between the sun and planets. Pray, what connexion is there between the cannon and iron about one of our ships of war, and the magnetic needle? And if such a small body

as the magnet has so powerful an influence, such immense bodies as the planets must produce effects the same as what we attribute to attraction or gravity. The numerous perturbations produced by the actions of the planets on each other, and in the lunar motions, &c., are I conceive, a demonstration of the stability of the Newtonian system.

I remain, Sir,
Yours respectfully,
J. UTTING.

Lynn Regis, Sept. 1st, 1827.

P. S. I think it not improbable, that the rotation of the planets on their axes may be produced by the motion of light emanating from the sun, and that the planets are so nicely balanced in their orbits, that, like *Archimedes*, if we had a stage to stand on by the circumference of the earth or planets, we might with a touch of the finger, communicate a rotary motion, without the assistance of such tremendous machinery as his fancy suggested for moving the earth!!

PATENT LAWS.

Sir,—I was perfectly satisfied to leave my letter on this subject, on the record of your pages, in juxtaposition with the observations with which you accompanied it, in introducing the form of a proposed petition; and did not purpose again to trouble you with further observations; nor did I expect that any other person would do so, considering that you invited only communications of "*matters of fact*" which might serve to substantiate the statements contained in the proposed petition. But as Mr. Dousbery has selected from my letter one or two passages, as texts for observation, I cannot admit, as by silence I might be supposed to do, that he has made any point therein. His objections in the first column, are answered by his admission at the top of the second; as the multiplicity which, he admits, cheapness would create, would occasion the inconvenience I anticipate; therefore it is very apparent "what the matter of cheapness" has to do with the subject. But the scope of my argument is not, singly and specifically, that patents would ever become, merely by being numerous, a paramount evil; but that consequences would result therefrom, involving greater evils than any resulting from the existing state of things: inasmuch as a carelessness would be induced, inimical to perfection of design, in the first instance; and to the perfect specification of design, in the second: and which, on either point, would induce piracy of an original, though perhaps crudely-formed or incorrectly specified, idea; in which case, participation must be submitted to, or the identity of the conflicting inventions disputed at law or in equity. The heavy charges now existing, operate to create extreme care and caution in maturing ideas, also in perfecting the means by which to render such ideas available, and also in clearly and specifically expressing those ideas and means. They operate also as constituting a self-inflicted penalty, if improperly incurred by any one seeking, under cover of a merely colourable difference, to obtain a patent, in piracy of a precedently existing grant. As letters patent admit of no amendment, this extreme care and caution is the more imperatively necessary; for should the slightest probable imperfection, or slightest possible improvement, afterwards become apparent, new letters patent must be obtained, as for a new invention: and this strictness is really absolutely necessary, in order to establish identity; for if B makes a thing different from, or differently than as specified by, A; it follows that he maketh not *the* thing, or useth not *the* means, specified by A; and therefore there being no identity, there is consequently no infringement. Now, in this conflict for supremacy, as matters now stand, a man weighs well the immediate outlay necessary, as well as the remote consequences he may incur, by attempting to establish a second

patent against, and to the extinction of a precedent one; and it is well known whether the present, or the contingent consideration, most influence: in consideration of the immediate and serious outlay, he prudently resolves to leave the patent undisputed; but would this be the case, if a reckless speculator, regardless of future consequences, and freed from the immediate consideration which the present expense involves, could for five pounds pirate the patent of any real inventor, by obtaining one upon a specification, differing only from the other the shadow of a shade? No! a lynx-eyed watchfulness would prevail, to take unfair advantage of omissions and imperfections; and every genuine genius, instead of finding himself protected in any valuable invention, would instantly find himself compelled to apply to Chancery for injunctions against a dozen other real Simon Pures, clothed in the same cheap garb; and the question would be, who was the real Pure? and it was in this most important point of view that I exhibited, "in dread array" (if T. D. pleases), the consideration of the costs of law proceedings.

In respect of what I have written in my former letter, as to the prerogative of the crown, I am certainly much misunderstood by T. D. I touched not the question, whether it was, or was not, a proper prerogative; I merely said it was an existing prerogative; and so it is. Whether it shall continue so to exist, to its full, or to any modified extent, will become the question between the petitioners and those who are put in authority over them; but that such prerogative should continue to exist, as now exercised, will admit, I think, of very easy showing.

I remain, &c.
W. DEYKES.

24, *Essex-street*,
1*st Sept.* 1827.

Admitting, for the sake of argument, all that Mr. Deykes contends for—namely, that piracies and lawsuits would be multiplied—we would still humbly maintain, that these evils would be far more than counterbalanced, by the many advantages which would result from the emancipation of inventive genius from its present shackles.—EDIT.

ON THE SOLUTION OF IMAGINARY OR IMPOSSIBLE QUANTITIES.

Sir,—In your 210th Number, page 110, there is a letter from W. Russell, in which that gentleman attempts to prove that $\sqrt{-a} \times \sqrt{-b}$ is *not* equal to $\pm\sqrt{a\,b}$. I therefore request your attention to the following lines, and hope to convince your readers of the correctness of my assertion.

Mr. Russell appears to deem it impossible that there should be *two* answers to the same question; but that such is often the case, every one knows. For if $x^2 - 42x = -216$, we find $x = 21 + 15 = 36$, or 6. But if I find $x = 6$, Mr. Russell may declare my answer to be wrong, because he makes it $= 36$, and would laugh at the idea of both our answers being correct.

But to the point:—At page 111, col. 2, Mr. R. says, "$\sqrt{b-c} \times \sqrt{b-c} = \sqrt{(b-c) \times (b-c)} = \sqrt{b^2 - 2b\,c \times c^2}$;" which is all very true. But in like manner, $\sqrt{-a} \times \sqrt{-b} = \sqrt{-a \times -b}$; but $-a \times -b = +a\,b$; therefore $\sqrt{-a} \times \sqrt{-b} = +\sqrt{a\,b}$. Also $-\sqrt{-a} \times -\sqrt{-b} = -1 \times \sqrt{-a} \times -1 \times \sqrt{-b} = -1 \times -1 \times \sqrt{-a} \times \sqrt{-b} = +1 \times \sqrt{-a \times -b} = \sqrt{a\,b}$. Also, $+\sqrt{-a} \times -\sqrt{-b} = -1 \times \sqrt{-b} \times \sqrt{-a} = -1 \times \sqrt{-a \times -b} = -\sqrt{a\,b}$. At col. 1, p. 111, it is said that "$+\sqrt{-a} \times -\sqrt{-a} = +a$." Very true; but it is also $= -a$, I believe; for $-\sqrt{-a} \times \sqrt{-a} = -1 \times \sqrt{-a} \times \sqrt{-a} = -1 \times \sqrt{-a \times -a} = -\sqrt{a^2} = -a$.

Your correspondent seems to doubt the orthodoxy of my former proof. I shall only ask him whether he denies that the product of the square roots of any two quantities is equal to the square root of their product?—as on this principle that proof was founded.

Mr. Ford's letter (No. 208, p. 80,) is calculated to mislead your readers.

My object, as I have already declared, was not to deny the correctness of his operation (in No. 196), but to prove that Mr. Darley's answer was right, and consequently that Mr. Ford's assertion to the contrary was *incorrect;* and this I believe I have done to the satisfaction of *all* your readers. Mr. F. himself appears sensible of this; for in his last letter he contents himself with repeating my assertion, "that not a tittle of his operation was incorrect," and says *nothing* in support of his former *charge.*

I remain, Sir,
Your's, &c.
HENRY OXLEY.

P. S. *Query*—The definition and peculiar properties of an *Irish Demonstration!*

H. O.

September 1.

ON THE MEANS OF EXTINGUISHING FIRES.

Sir,—It is not without some hesitation that I notice Mr. Baddeley's instructive communication since mine of the 31st ult., being fearful he may think me tiresome: but fires appear to me so dreadful, that we cannot have too much information on the subject of preventing their progress.

The objections which occurred to me respecting Mr. Buston's plan were these:—1st. It gives a fireman the means of engrossing the whole of the water, after sufficient has been turned on for five or six engines. Now firemen are not very ceremonious * (perhaps it is proper that they should not be so), and, generally speaking, every one likes to make his own engine the most efficient, or at least to appear so. 2nd. Would not the force of the water, acting in suction-pipes,* force the leathern coating from the spiral or rings which prevent it from collapsing? In my opinion, they would be injured after three or four times' trial in this way. 3rd. The fireman will, probably, endeavour to act independent of the turncock, and proceed to the fire without him. I know a great deal of mischief arises from not calling the turncock before the firemen; they should act in concert. With Mr. Buston's plan, a fireman may put the stand-cock in a plug on the service-pipe, instead of the main-pipe, and no one being able to tell where to find the service-cock, somebody goes for the turncock, and then half an hour is perhaps lost. The water-companies, I believe, keep their mains charged to a certain extent; and however competent a fireman may be, I am persuaded the turncock is of great importance to his operations.

Still, notwithstanding these objections, I think Mr. Buston's plan will prove so useful, that every engine should be fitted with it.

Since I read Mr. Baddeley's of 21st inst., I have seen the posts in the Temple, which are certainly very superior. I also saw one of the New River Company's posts in the Strand: but I can assure Mr. B. they are inferior to the Grosvenor district posts. The screws of these are of cast iron, and the waterway is only 1¾ inches in diameter; while the Grosvenor district posts are 3 inches in diameter; and if Mr. B. still doubts about the force of the water,

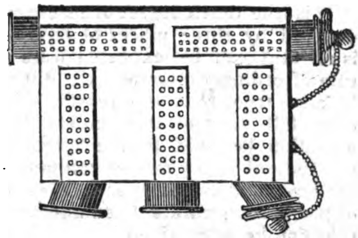
* At the fire near Ludgate Hill, about three years ago, I saw a New River turncock endeavour to make some of the firemen move their engines, and work from different plugs, instead of continuing at one plug, which did not furnish enough water. A great outcry was occasioned by this exercise of authority: but the turncock was determined, and stopped the plug, to compel the removal of some of the engines; which irritated one of the firemen so much, that he struck the turncock with a crow-bar, and cut his head open, thereby rendering him incapable of assisting the firemen. I was much hurt at seeing this, as I had a confidence the turncock's arrangement would have furnished plenty of water for all the engines.

* I cannot reconcile the term section for suction. I have asked several workmen about it, and they all say it is suction. Scientific men are opposed to the word suction: but however erroneous it may be, it is the most familiar term amongst practical mechanics.

I am certain he would be satisfied if he saw one at work. I find the trustees of that district employ a regular fireman (lately belonging to the Eagle Insurance Company), who has an engine and apparatus under his care.

From all my observations, I think fire-engines work best with clean water; and I have seen dirty water injure the furniture of houses adjoining a fire very much: as to dirty water being effectual in extinguishing fires, it may be so—but, compared with clean water, the difference cannot be much.

I have thought a great deal of Mr. Baddeley's iron canals, and like the idea much. Would not our old enemy, however, "mud," stop them up, if they were made so small as 2 inches by 4 inches in Macadamized streets, particularly in streets where the fall or current of water is trifling? If they were made larger, say equal to a 5-inch pipe, then I fear the expense would be too great. I inquired at a founder's the other day, and was informed 5-inch circular cast-iron pipe, about 70 lbs. weight per yard, would cost about 7*s.* 6*d.* per lineal yard; and the laying down without lead joints, including paving, about 1*s.* 6*d.* per yard. I suppose, too, the canals and gratings would cost more than this. At the Horse Guards, St. James's Park, I have seen brick trunks, 2 feet long, 18 inches about wide, and 2 feet deep, with a fire-cock in them; they are 40 feet from the building, and, if I remember right, 100 feet apart, with a stone to cover them, which can be lifted off by a ring; each fire-cock is fitted with a screw to connect the hose, so that the engine-tubs can be filled, or the suctions of the engines worked in the tanks. I have seen a similar one, I think, in front of Westminster Hall. Perhaps generally they would not answer in the streets: I am aware that there is a great deal of time lost, as Mr. Baddeley states, in breaking up the paving, and it has always appeared to me a barbarous proceeding. Could not each engine be furnished with a cistern of 2 cubic feet in capacity (see sketch), to be placed on the pavement, and to be supplied by the stand-cocks



and leather hose; the roses to be fixed in the cistern, and to have male screw-caps attached with chains to stop those not wanted?* At present, a great deal of time is lost at fires in stopping up the sewer-gratings with what, I believe, are termed hammocks; sometimes dung is used; still I have heard a great deal of water escaping through the gratings. A few years ago, seven or eight engines were thought a great many to be seen at a fire; now it is not unusual to see fifteen or sixteen engines; and I must state, that the water companies' means of supply do not appear increased to any great extent.

I am, Sir,
Your's, &c.
A PEDESTRIAN.

London, Aug. 27, 1827.

EFFICACY OF SALT IN RENOVATING BARREN APPLE-TREES.

Sir,—Salt is very efficacious towards rendering barren apple-trees highly productive of fruit, by being spread on the ground round the trees, at a small distance from the trunks. Mr. Gilbert, the late Duke of Bridgewater's servant, made this experiment upon his apple-trees with very great success.

Your's, &c.
JAMES COX.

June 5, 1827.

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* I consider the difficulty of the hose-screws being of different sizes, and the threads of the screws different, may be obviated in some way.

MR. BEVAN'S SLIDING RULE.

Sir,—I will reply very briefly to Mr. Bevan's letter (No. 208, p. 71).

It is true that a degree of accuracy denoted by three places of figures, is all that can be expected from a rule of ordinary dimensions. But it is also true, that the results will often fall short of this, unless due attention be paid to the minutiæ pointed out in my former communications; and one of these is, the use of the most accurate fixed numbers that can be determined.

The misquotation of Mr. B.'s numbers, was not in my original draft; it arose either in copying, or in printing.

It ought to be known to your readers, that Mr. Bevan is the inventor of the admirable method of expressing formulæ for the sliding rule, adopted by myself and other contributors to your pages. This method, from its great superiority, will doubtless be used by all future writers on the same subject.

I am, Sir,
Your's truly,
J. W. WOOLLGAR.

47, *Essex-street, Strand,*
August 30, 1827.

CONCENTRATION OF SOLAR HEAT IN GARDENING.

We learn, from the last number of our well-informed contemporary, "The Gardeners' Magazine," that a Mr. Gauen is about to bring forward a very ingenious invention for hastening the maturity and increasing the flavour of fruits, and for flowering with greater vigour every description of exotic plant. The effect is produced by concentrating the sun's rays, by means of lenses which may be self-adjusted by watch machinery, on a hollow cast iron ball; with one opening at the lower extremity, to admit the air to be heated in the ball, and another on the upper surface, to allow the heated air to pass off through iron tubes, which it heats in its passage. These tubes are proposed to be distributed at pleasure among the trees or plants on which it is intended to operate.

NOTICES TO CORRESPONDENTS.

We feel much obliged to our friend Tim Bobbin for his prompt attention to our wishes; but he will have seen, from our 210th Number, that we had previously obtained, from another source, what was wanted (though not, certainly, in so neat a style).

Replies by Mr. Weekes to T. C. E. on the Safety Gas Deflagrator, and by Mr Harris to Lieut. Green on Lightning Conductors, in our next.

Also in our next, T. S. S., and, if we can get the engravings ready in time, the Vindication of Mr. Hookey's Rudder Improvements.

Communications received.—F.—N.H. —Gramina —C. Peek— Bobbin Net— J. J. — R. Cross — Mr. Baddeley — G. Clark — W. Dowling — A Mechanic— B.—W. C.

ERRATA—In the title of Mr. Gilman's paper, in last Number, p. 121, for "On Heat, and its Economical Conversion into Steam," read "On Heat, and its Economical Application to the Conversion of Fluids into Steam." p. 125, col. 1, l. 6, for "*stove*" read "*store*."

In the "Remarque sur la Solution de G. S.," p. 127, the multiplication sign × has throughout (except in the first instance) been used for that of addition +. We have often thought that it would be a great improvement in numerical notation were the left-hand stroke of the former sign doubled thus ⨯; it would make the difference between × and + more *immediately* apparent than is, at present, always the case; and, in manuscripts especially, would greatly facilitate the labour of the reader. Should this suggestion be approved of by our arithmetical friends, we shall have some new multiplication signs, thus altered, cast for the use of our Magazine.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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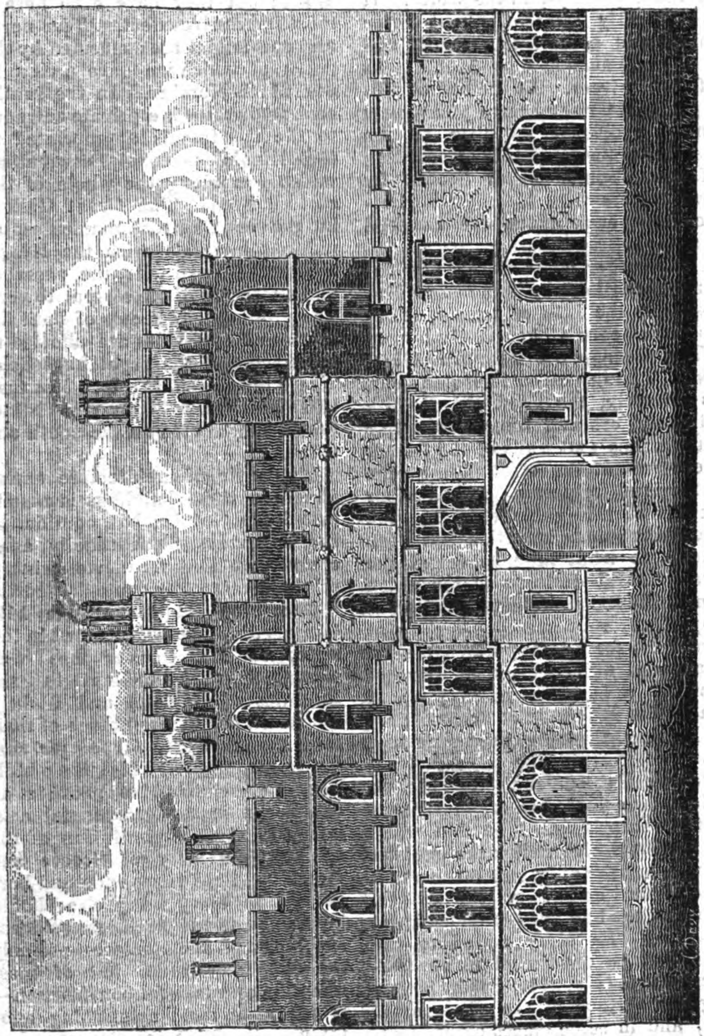
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 213.] SATURDAY, SEPTEMBER 22, 1827. [Price 3*d.*

" Beauteous Windsor's high and storied halls,
Where Edward's chiefs start from the glowing walls."—WARTON.

KING GEORGE THE FOURTH'S GATEWAY, WINDSOR CASTLE.



ON THE IMPROVEMENTS OF WINDSOR CASTLE.

(From the Communications, chiefly, of Mr. C. Davy).

NO. II.

York and Lancaster Towers, and Great Quadrangle.

There are few who have not read or heard of the Long Walk in Windsor Park—one of the most majestic avenues, perhaps, in the world. It is perfectly straight, about three miles and a half in length, and shaded on each side by double rows of stately trees. At the end of this walk there rises before you a new and magnificent entrance to the Castle, on the south side; consisting of a handsome portal, flanked by two towers with machiolated battlements, each about one hundred feet high.

The corner stone of this new entrance was laid by his present Majesty, on the 12th of August, 1824; and it is hence appropriately named *King George the Fourth's Gateway.* The towers on each side bear, as formerly, the good old English titles of York and Lancaster. The foundations and walls of the former were part of the old building—the latter is entirely new. In the minor details of this noble entrance, the most scrupulous attention has been shown to what may be called the architectural costume of the olden time. The numerous machiolations (apertures supported by corbels or brackets, for pouring down melted lead, and other weapons of annoyance on a besieging enemy) are in particular strikingly characteristic.

Passing through this gateway, you enter into the *Great Quadrangle* of the palace. The change which two years has produced here is truly surprising. The first grand alteration which strikes the eye (as in viewing the exterior) is the great additional height of the edifice. This effect has been produced not only by the story added to the building, as mentioned in our former notice, (No. 211,) but by lowering the surface of the whole area, six, and in some places eight, feet. On the south and east sides (the only sides yet completed) there is a noble corridor all round, forming a gallery, which, for size and splendour, can have few rivals. In the prefixed engraving, the York and Lancaster Towers are exhibited, as seen in connexion with this gallery, from the interior of the Quadrangle. The towers have not, of course, so stately an appearance when viewed from this spot as from the Long Walk; but they have even here a most impressive effect. The north and east angles are connected by the porch of which we gave a view in our 211th Number. In the south-east angle there is a private entrance to the apartments appropriated to the King's personal occupation, which run along the whole of the eastern front. The Great Gallery in the corridor communicates, at different intervals, with the King's apartments, and with the passages and staircases of the several towers. The ground floor rooms of both the south and east sides are allotted to the officers of the royal household. There have been, in all, no less than three hundred and sixty-nine distinct rooms constructed on the south and east sides.

The style of architecture exemplified in these buildings is usually called the Gothic; but, considering the barbarous ideas usually associated with that term, we think it might be more fitly denominated the "Decorated English of the 14th Century." Structures erected in this style, as Mr. Brewer has well remarked (Introduction to the Beauties of England and Wales), "present, in the assemblage of their several perfections, *the single surprising instance* in which the middle ages were enabled to produce an excellence in the ornamental arts, independent of all imitation of the sublime simplicity of Greece and Rome." That times rude and barbarous in every thing else should have produced such magnificent specimens of architecture—not only of vast magnitude, but of most scientific and tasteful construction—is indeed a most astonishing anomaly. Examine any part of a

Gothic structure—its pendentive ceiling, or deep-seated groin;—you will recognize at once a geometrical skilfulness in combination, which even the most enlightened and polished ages have not surpassed. The perfection which the art of architecture singly attained in these times, is generally allowed to have been owing to the institution of Freemasonry, and to the superior honours and privileges conferred on the members of that craft. According to Sir Christopher Wren (Parentalia) the Freemasons consisted of associated bands of itinerant builders, who ranged from one country to another, as they found churches and castles to build, enjoyed many valuable immunities, and were favoured alike by clergy and laity. Among the most remarkable of the privileges they enjoyed, was that of fixing their own prices of labour, &c. Individuals of the highest rank sought with avidity the honour of being admitted a member of the craft. Sir Christopher Wren himself filled the office of Grand Master at a later period—a fact the more remarkable, considering the extreme dislike (not always to the advantage of his reputation) which he showed to the style of his Masonic predecessors. The Grecian style of architecture, which Wren laboured so much to introduce, has almost entirely superseded the Gothic in this country; but much might, we think, be advanced, to show that the change has neither been in conformity with the taste of the people, nor with the circumstances of a northern climate.

The Grecian style is that of the glade and bower; the Gothic that of the mountain and forest. The one is best suited to buildings of one height, and to a mild and serene climate; the other to lofty fabrics in a region of storms and tempests. The Grecian admits not, in strictness, of windows (the light in Grecian buildings being admitted from above, and but a slender roofing from the weather being required); the Gothic is peculiarly adapted to their introduction, and is therefore the more suitable of the two to a wintry climate like ours. The great and distinguishing feature of the Gothic consists in its arches: of these there are many elegant varieties; and all are alike of nearly equal applicability to gateways, windows, roofs, &c. The windows, where space allowed it, were expansive, with the heads lightly adorned with tracery; and the whole were divided into many lights. These windows were denominated *bay* windows; and, in ecclesiastical structures, were extended to an immense size, richly furnished with painted glass, representing various *stories* of saints, miracles, &c. Hence the phrase "storied windows." Mr. Brewer has some observations on the ornamenting of these windows, which are deserving of attention.

"In these windows," he says, "we behold disposed, with lavish munificence, the attractive and appropriate splendour of painted glass, conducive to the intended object of the structure, illustrating passages of sacred history, revealing tales of saints and martyrs, and perpetuating, in the rude portraiture of the times, the effigies of kings, prelates, and founders. The fascinating influence of stained windows, even in intellectual ages, when the sanctity once attached to the fabulous parts of their narrative is forgotten, or only remembered with a smile, is acknowledged by every spectator of taste and feeling."

Do not these sentiments call to mind the present state of our *historical painting?* Why should the sister arts be separated, when they are so generally acknowledged to share each other's beauties, and when the perfections of one are *comparatively* cold and insignificant without the embellishment of the other? While we applaud the taste which has dictated the present improvements at Windsor Castle, we cannot regret too much the entire seclusion of pictorial ornaments. No lack of judgment seems to be shown in restoration, either externally or internally; for the same spirit which guided and revived the architecture of the third Edward, has, in the *internal* decoration, produced all

the imperial pomp and voluptuous decorations of the age of Louis XIV. (the two ages which are the prototypes of those of Augustus of Rome and Pericles of Greece). Pity that the fostering hand of royalty, hitherto so ready in affording assistance to British artists, should be withheld in a moment so advantageous to the perpetuating of their names to future ages. It is not the hanging of pictures in handsome frames against bare walls alone that will tend to increase the *value* of painting, although it may tend to promote it. In such *splendid palaces* as this, we would have them *associated with architecture.* Let them go lovingly hand in hand; then we shall find architects and painters labouring in mutual support of each other's productions; and then may we expect to see historical painting rescued from the ruin with which it is now threatened.

(*To be continued.*)

ON RENDERING STAGE-COACHES SAFE.

Is it desirable to increase the safety of travelling by stage-coaches?

Mathews's patent, certainly, had such effect: but his coach was said to be a "heavy drag" to the horses. —Stage-coachmen say they like coaches which are "springy," and have "play" in following; and that, though heavier, such do not injure horses so much as a lighter, monotonous "drag," which is never off the collar. Now, how are these *lightsome* qualities of a coach to be preserved without detriment to the paramount principle of safety? This is a question for mechanics and artisans: for (all dangers defying) the public will travel fast; and (with all our improvements) coaches sometimes, yet, overturn. The greatest danger seems to be in going down hill; when a good coachman is almost feverishly anxious to hold his horses up, though sometimes unwilling to lose time by dismounting to lock and unlock a wheel, which, nevertheless, it is necessary, for safety, should be done. But why is it necessary? because, I believe, that otherwise the coach, inclining so greatly forward, bears so heavily and unmitigatingly on the pole, which, by the end chain, is fastened to the collars of the wheel-horses, that the poor animals are, as it were, pinned down to the earth—the stress being upon their necks, and, consequently, forcing the extremest exertion (under disadvantageous facilities of action) from the fore legs; in which exertion should they fail, they are thrown with violence to the earth. This consequence results from the pole having no motion, but one parallel with the plane of the earth, and, from its connexion with the fore wheels, being held and retained in a line with the perch; which being the connecting medium of the fore and hind wheels, is itself held, and is the cause of retaining the pole, parallel with such plane. It appears to me, that if the wheel-horses had power to elevate the end of the pole, and thus obtain freedom from the great pressure of weight upon the collars, the cause of considerable danger would be obviated: but this, I conceive, cannot possibly be effected in the case of four-wheeled carriages. If six wheels, however, were adopted, I think the facility might be gained. I think that six-wheeled and two-wheeled carriages might be assimilated in principle. Thus the centre axle would admit of equipoise: if the preponderance of weight were behind such axle, on going down hill, the small fore-wheels would be wholly relieved from superincumbent weight; and, by proper construction, the pole might be raised to any angle with the horizon, and the horses thus relieved. If the preponderance of weight, on going up hill, were in front of such centre axle, it is believed the ascent would be less difficult than it now is; but this is not asserted confidently. It might be an improvement, also, of the principle, if the fore and hinder wheels were made so as, alternately, not to touch the road, according as the preponderance of weight, being either in front of or behind the centre axle, should raise either the fore or the hind wheels; in which

case, only four wheels would ever be in action at the same instant of time: and this principle would admit of wholly taking from the fore-wheels the superincumbent weight on going down hill; and therefore ease the horses, and, I think, render "locking" unnecessary, the coach safer, and also admit of its being subject to full play upon its springs.

You seem to have some quarrelsome correspondents, who use *suggestion* as a ground for hot controversy and sour criticism; not for the advancement of science, but to throw off spleen and bile: to such I do not address these suggestions; but to the good-natured geniuses, who, if they fell in with a vessel of cream, would rather undergo the labour of churning it to butter for use, than, in ill-natured sport, curdle and spoil it with vinegar: but some birds will hatch no eggs but their own. I, having not the warmth of genius necessary, beg leave, with your permission, to place my *ova* in the nest of your Magazine; and if one of your readers will foster it to incubation, the public will be served, and perhaps himself.

I am, Sir,
Your's, obediently,
W. D——s.

INCREASE OF HUMAN FOOD.

Sir,—The extract you have inserted from the "Caledonian Mercury" in No. 209, is decidedly a very valuable paper, showing that the resources of the country are far from being generally appreciated as they ought; and though I am convinced the picture is too highly coloured, I acknowledge the writer to have been successful in showing the vast superiority of the potato over wheat, in the quantity of nutritious substance produced. From the many experiments on the nature of flour, on the different species of starch, on gluten, &c. which I have made, I am satisfied that many of the writer's observations are not correct; and, therefore, calculated to injure the cause he appears to have so much at heart.

In the first place, the quantity of starch in potatoes is estimated much too high; there may be some that contain as much as 25 per cent., but the average quantity falls far short of that. I have many times found that potatoes, on the average, contain three-fourths, or 75 per cent. of water. By adding potato-starch to common flour, in the proportion of one third or fourth, you make a much superior bread: but that it will make "the finest sort of loaf-bread, when mixed with eggs, or mashed potatoes," is certainly most untrue. It is also said to be "superior, *in all respects*, to wheaten flour, and equal to arrow-root;" and that the prohibition alone prevents it from being used in the stiffening of linen, &c. This, too, is wholly erroneous: so far from being superior, I believe it to be inferior to flour in most respects. Of this I can soon convince any unprejudiced person. Wheat-flour, it is well known, does not consist of starch alone, but contains other vegetable principles: and though the writer in the Mercury speaks of "the conversion of potatoes into flour" as an easy process, I believe it to be a process quite out of the reach of human ingenuity. One hundred parts of good flour consist of,

Starch	. .	68 parts.
Gluten	. .	20 do.
Sugar	. .	5 do.
Gum	. . . .	4 do.
Albumen	.	1 do.

Without a due proportion of the three first articles, bread cannot be made. The sugar, on fermenting, supplies the carbonic acid, and thus distending the gluten, forms that spongy tissue which holds the particles of starch in separation. The gluten is admirably adapted for this purpose; and there is nothing which convinces me so much that Providence intended man, in a state of civilization, to eat wheat in the form of bread, as the fact of its containing that singular substance. While it answers the above important purpose, it is itself by far the most nourishing substance contained in flour; resembling, in its habitudes and in its constituents, the flesh of animals;

containing a fourth constituent—nitrogen; and not being distinguishable from animal substance on analysis; not being subject to the vinous fermentation, but the putrid; burning like horn, and supplying ammonia on destructive distillation, and a gas which burns as brilliantly as that from oil. Though sugar, gum, &c. may be easily added to potato-starch, he must be an ingenious person indeed, who can supply a substitute equal to gluten. The assertion that potato-starch is equal to arrow-root, needs not much refuting: it is of a much coarser nature, being easily distinguishable by the eye; and, when boiled, being too thick and glary, and having (to most persons) a disagreeable mawkish taste. As respects its being used as a stiffener, it is too soon "blown out of the linen," as most housewives know; and our dyers and stiffeners have long since discarded it, as totally unfit for their purpose. I know only of one person who has made use of it successfully in the manufacturing line, and he chiefly uses it to give a particular kind of goods *weight* and *body*, which its want of strength enables him to do, without making them too stiff.

There is another assertion in the paper which ought not to be passed over uncontradicted; that of potatoes being "the worst of all human food." When grown on bad land, and badly cooked, they are certainly unwholesome; but here, in Lancashire, where they are produced in great perfection, they are quite another thing. The following anecdote will throw some light on this point:—A gentleman, from a more southern county, dining some years ago in Manchester, declared he could not eat the Lancashire potatoes, they were so inferior to those grown in his neighbourhood. "Your potatoes," says he, "fall down with a touch of the knife, while ours cut like wax." There are still many persons so besotted as to contend that sad potatoes are the best. They are *sad* fellows.

I am, Sir, your's, &c.

BENJ. GOULSON, Surgeon.

Pendleton, Aug. 30, 1827.

NARRATIVE OF THE ERECTION OF THE MENAI BRIDGE.

(*Concluded from page* 136.)

Dimensions of the Iron-work.

The chains, 16 in number, consist of 5 chain-bars in each. The length of each chain-bar is 9 feet 9 inches, and 3 inches broad by 1 inch thick; with 6 connecting plates at each joint, 1 foot 6 inches long, by 10 inches broad and 1 inch thick; secured by two bolts at each joint, each bolt weighing about 56 lbs. The total number of chain-bars in the cross section of the chains is 80. The extreme length of the chain, from the excavations in the rocks, is 1714 feet upon the surface of the road-way.

The length of the suspended part of the road is 553 feet; consisting of two carriage-roads of 12 feet each, and a foot-path of 4 feet in the centre.

The vertical rods, an inch square, suspended from the chains, 5 feet apart, support the sleepers (or road-way bars), which form the flooring of the road-way.

Opening of the Bridge for public Accommodation.

On Monday, Jan. 30, 1826, this stupendous and singularly unique structure was opened to the public, at 35 minutes after one o'clock, A. M., by the Royal London and Holyhead mail-coach, conveying the London mail-bag for Dublin. Mr. W. A. Provis, the resident engineer, had received instructions from the Commissioners to meet the London Down mail at Bangor Ferry Inn, and there take charge of it across the bridge.

As soon as the horses were changed, he got upon the mail-coach, accompanied by Mr. Ackers, mail-coach superintendent; Mr. Hazledine, the contractor for the iron-work; Mr. J. Provis, the superintendent for proving and examining it; Mr. Rhodes, the director of the iron and timber work; Messrs. J. and W. Wilson, sons of the contractors for the masonry; and as many more as could find room to sit or stand, or even procure a place to

hang by. Thus loaded, the mail-coach proceeded on about a quarter of a mile to the toll-gate, which was immediately thrown open, and it passed across the bridge in grand style. By the particular and modest request of Mr. Telford, the architect, a regular and splendid procession, as at first intended, was dispensed with; to the serious disappointment of at least 5000 persons, who had assembled on this memorable occasion.

The cloud of disappointment, however, soon dissipated, and the numerous pedestrians from both counties continued parading along the beautiful platform road-way for several hours: joy, admiration, and astonishment seemed depicted in every countenance. During the day, the rain fell in torrents; but towards mid-day the weather cleared up, and the afternoon was fine.

Wednesday, February 1, 1826, the first three-masted vessel that passed under the bridge was the ship Melantho, of Carnarvon, homeward bound from Liverpool, with all her spars up, and sails set, commanded by Captain Lloyd; piloted by David Hughes, of Bangor. Her topmasts were nearly as high as those of a frigate, and yet cleared 12 feet and a half below the centre of the roadway. An inconceivable number of foreigners, of the highest celebrity, came at different times to witness the progress of this wonderful bridge.

This national and splendid specimen of British architecture will be a lasting monument to the discernment of the present Government, for having called into requisition the transcendent talents of Mr. Telford; who has thus, by a positive proof of superior scientific knowledge and taste, signalized himself, in this line —the first architect of the age.

I am, Sir,
Your humble Servant,
T. B.

MAGNETS.

It has been hitherto found, that if five single magnets, each raising one pound, are put together, the compound magnet formed of the whole, instead of raising five pounds, only raises three. A young mechanic of Edinburgh, named Jackson, is stated, in the "Scotsman," to have at length devised a very simple method (not yet, however, divulged) of combining any number of single magnets, by which the power of each is preserved entire in the compound magnet; or rather increased. At an experiment witnessed by the Editor of the "Scotsman," five small magnets raised fifteen times their own weight, and a few pounds more than the aggregate force of the whole.

BREWING.

Sir,—I am obliged to your correspondents, "T. T." and "A Brewer, Cork," for their information on the subject of brewing. I hope they will excuse me, when I say the matter requires a little further explanation; especially that part concerning the gluten. It is evident that the art of brewing is but little understood, though so generally practised; for few people adopt the same rules, nor can one practitioner in a thousand give a satisfactory reason for his process. If I am told by one person to boil my wort one hour, and by another three hours and a half, how am I to decide upon the correct time, unless a principle be laid down, from which a rule may be inferred?

In Vol. V. p. 254, is the following rule, "boil till all the gluten is deposited." It is the *rationale* of this rule I wish to understand.

I have read, that wort consists of saccharine matter, starch, *gluten*, and mucilage; that gluten is insoluble in water, and, when dry, nearly resembles glue in appearance; that the object in boiling seems to be to incorporate the essence of the hops with the wort, and to deposit the gluten. Now, if such be the character of gluten, it must be decidedly unwholesome, because it must tend to cause indigestion, and that beer must be the best which is most free from this substance; therefore it becomes a matter of

importance, to have some easy criterion whereby prejudiced and ignorant servants (to whose whims most private brewings are consigned) may judge when the wort is sufficiently boiled.

Is not the specific gravity of the wort increased by boiling, on account of the great evaporation? if so, why should the gluten sink in a heavier fluid, when it did not in the lighter one?

With reference to the "Brewer of Cork" advising to boil three hours and a half, I will give him the following case.

Wishing to fill a twenty-three gallon cask with ale, I allowed three bushels of malt and two pounds of hops. I mashed with forty-three gallons of water; it stood three hours, and I run off thirty gallons of wort. I boiled one hour, and had then about twenty-four gallons to tun with. Since six gallons were lost by evaporation during one hour's boiling, we may infer that twenty-one gallons would go off in steam in three hours and a half.

It would then be

Absorbed by the malt . .	13 gal.
Waste by steam in 3½ hours	21 do.
Residue to fill the cask, and waste	24 do.
	58

Thus 58 gallons of water must be used in the mash to brew this small cask of ale.

If, to make beer wholesome, it really be requisite to give this long boiling to the wort, I, for one, must give up my family brewings, unless I can have a boiler that will hold 100 gallons at the least,—an article which is rarely met with, except in large establishments; I need not say the expense of fuel would frighten our English housewives out of their wits.

I fear I have trespassed too long on your valuable pages; but, Mr. Editor, you know that glorious October will soon be here, when it is John Bull's custom to brew his "nut-brown ale;" therefore any assistance you can obtain for him, to improve his favourite beverage, will, I am sure, be thankfully received; and the importance of the subject must be my apology in troubling you so long.

I am, Sir,

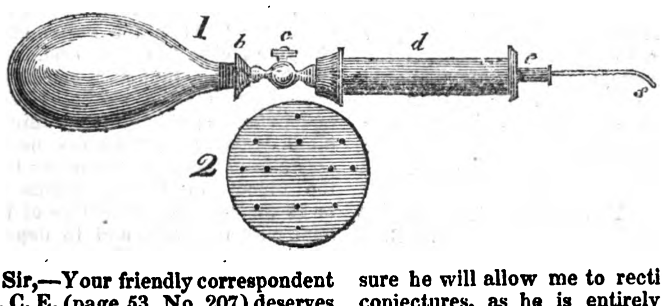
Your humble servant,

A. Z.

Purton, Wilts,
Sept. 11th, 1827.

P S. If your Cork correspondent be professionally "A Brewer," it is highly creditable to him, and characteristic of Irish liberality, so kindly to benefit the world with his information.

MR. WEEKES'S SAFETY GAS DEFLAGRATOR.



Sir,—Your friendly correspondent T. C. E. (page 53, No. 207) deserves my thanks for the notice he has bestowed on my efforts, humble as they are, for the advancement of my favourite science; and I feel sure he will allow me to rectify his conjectures, as he is entirely mistaken in supposing me unacquainted with the ingenious contrivance of Mr. Gurney. As most apposite to to my purpose, pray excuse me, sir,

in quoting a short paragraph from the *Essay on the Combustion of the Gases*, page 426, vol. vii. *Mech. Mag*.

"So singularly potent and combustible in its nature is this igneous oxy-hydrogen jet, that even *the interposition of a water-trough, with other additional means, as a medium of safety*, has failed to prevent an explosion in an oil-silk gasometer," (used instead of a bladder, as recommended by Mr. Gurney) "connected with proper jets for experiments in chemistry and mineralogy; the stream of ignited gas rushing through the supposed safety-trough, and rending the apparatus to pieces." This passage I am satisfied must have escaped the observation of T. C. E. or he would have inferred that I was writing of an apparatus constructed precisely on the ingenious principle of Mr. Gurney. In short, sir, I have frequently seen Mr. G.'s blowpipe employed, and have used it myself; but I seriously assure your correspondent, that my esteem for Mr. G.'s talents is such, that I studiously avoided any direct mention of his valuable invention, because I would not seem to invite comparison between the merits of his instrument and the one I was describing. Now that the comparison of the two instruments has fairly made its way into the pages of the *Mechanics' Magazine*, and the invention I have described is sanctioned by your kind approval, I trust I may be excused for indulging in a few additional observations.

I am conscious that I am without the slightest invidious feeling, when I lay down the position, that the security afforded by Mr. Gurney's blowpipe is of the negative description; the interposition of the water-trough and layers of wire-gauze, does not invariably prevent the retrocession of the flame; and when this obtains, an explosion in the gasometer is a certain consequence, and one which I have not unfrequently witnessed, though it is probable such accidents are more common in the hands of some operators than others. It is true, no dangerous effects would be likely to result "from the rupture of such a soft material:" but the apparatus is thus rendered useless until it has undergone repair; time is necessarily lost; and, as the ardent lover of chemical research has frequently experienced, moments occur in the warm pursuit of his object, which, if suffered to escape, the future cannot restore. Though I feel it incumbent on me to declare that I have never known any personal injury of consequence to ensue from an explosion of the bladder gasometer, I have known of the destruction of some valuable philosophical apparatus placed on the table near the blowpipe, and incident on the violent concussion and confusion arising from the explosion of the gasometer, besides defeating the success of an important experiment in the hands of an otherwise most successful operator. Hence I am led respectfully to submit this question: since it is known that explosions may and do happen, notwithstanding the interposition of wire-gauze and water-troughs, which are contrivances by no means so simple in their principle and application as a straight brass cylinder carefully charged with common sponge, which is not only "quite as effectual," but affords an *absolute* security; am I not justified in giving preference to the sponge medium, leaving out of the inquiry any advantages which may obtain from the adoption of other parts of the apparatus connected with the Safety Gas Deflagrator? I repeat, Mr. Editor, that where the apparatus is constructed strictly in accordance with the directions I have given, no retrocession of the gas flame ever has, or in my opinion can, happen.

I entertain no doubt but that Mr. Gurney "has produced a flame ten inches long," with his apparatus; and I beg to assure T. C. E. he may produce the same length of flame, and even *greater*, by employing a proper jet, with the Gas Deflagrator. But as your correspondent is conversant with experiments of this

nature, I am persuaded he must have observed that the *length* of the oxy-hydrogen flame is not of so much importance; for, what I have invariably observed myself, I find Mr. G. has most ingeniously and satisfactorily proved, in his observations on some curious phenomena concerning flame—viz. by holding a bar of platina in a flame produced by the blowpipe, it increased in its temperature as it approached *nearer* the jet. The point of greatest heat is, in fact, invariably found near to the orifice of the jet from which the gas issues, and where a very marked difference in colour of the flame may be constantly observed; beyond this point the degree of heat is infinitely less, consequently the length of the flame avails us nothing practically. But though length of gas flame be not important in these experiments, its *diameter* is of the very first importance; for by this increase we are enabled to bring much larger bodies within the sphere of its action; and (I speak from experience) the principle of the gas deflagrator will enable the operator to increase the diameter of his jets to a far greater extent than any other means with which I have the happiness to be acquainted, and that without diminishing the degree of security, if the requisite attention be not neglected.

For the general operations of the scientific chemist, I am persuaded the *forms* of Mr. Gurney's blowpipe and the safety gas deflagrator offer several advantages; yet I will avail myself of the opportunity, while on this subject, briefly to describe a very economical and portable substitute for the latter, which I have found very convenient and useful on a variety of occasions, but more particularly where large flames are not required: *a* represents a common bladder, capable of holding from a quart to three pints or upwards, mounted with a ferrule* *b*, into which screws the stop-cock *c*, the opposite end of which is attached in like manner to one end of the safety tube *d*, six inches in length and one inch in diameter, which, when in use, is to be charged with sponge, as directed at page 440, Vol. VII. *Mechanics' Magazine.* This tube *d* is furnished with a nozzle *e*, into which screw the several jet pipes, which I find most convenient in their form when somewhat curved near the end, as shown in the figure at *f*. The bladder being charged with a mixture of the gases, the mode of employing this simple apparatus must be obvious, and is entirely free from danger owing to the explosive nature of the gases. The nozzle *e*, with its milled projection, fits air-tight, by being ground upon the end of the tube *d*; and is thus readily removed for the convenience of charging the safety-tube with sponge, upon the end surface of which, next the jet-pipe, the thin circular plate of brass, fig. 2, perforated with 10 or 12 small holes, is placed before replacing the nozzle *e*. This plate prevents the surface of the sponge from being otherwise slightly singed by the ignited gas rushing backward, when the pressure of the hands on the bladder may be suddenly suspended.

It will illustrate the inefficiency of the *water-trough* as a security against explosions, when it is stated, that, with the above simple apparatus, wood may be burnt, wires of various metals heated to redness, and numerous combustible substances fired beneath the surface of a vessel of water, by exerting a moderate degree of pressure upon the bladder with the hands, and introducing the flame beneath the water slowly. One of the most brilliantly beautiful effects which I have ever witnessed by means of the oxy-hydrogen blowpipe, obtains from submitting a piece of watch-spring four or five inches in length to the action of a moderate size jet. Perhaps there is no mode which so beautifully exhibits the combustion of a metallic substance.

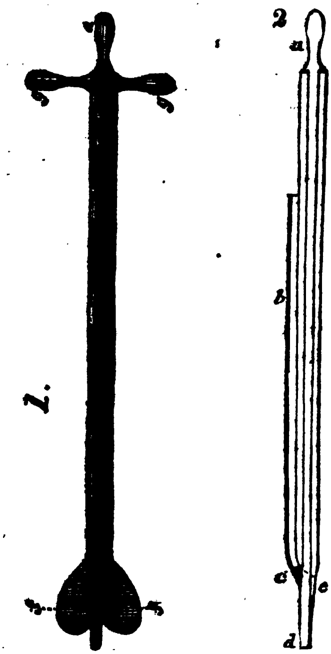
I am, Sir, your's, &c.
W. H. Weekes.

* Every description of ferrules, tubes, &c. of the very best manufacture, I am in the habit of obtaining from Messrs. G. and R. Knight, Foster-lane, Cheapside, London.

MR. WAISTELL'S ACORN DIBBLE—ADDITION BY WHICH IT MIGHT BE MADE APPLICABLE TO DIBBLING GRAIN.

Sir,—Perhaps a little addition made to the late Mr. Waistell's acorn dibble (an engraving and description of which accompanies this) would answer the purpose of Ceres, (see your No. 176,) and be still equally useful for its original intention.

Description of Mr. Waistell's Dibble.



"*a* represents the handle of the dibble, which dibble is a rod three-fourths of an inch in diameter; moveable in the tube of a stave, which stave is externally about two inches diameter; *b* a tin or metal tube fixed on the exterior part of the stave, and of the same bore or aperture of the tube in the stave: when a hole is made in the earth by the point of the dibble, *d*, the acorn is dropped down the metal tube; and on drawing up the dibble by its handle to the height of the letter *e*, the acorn *c* passes through a large opening into the dibble tube, and from thence falls into the hole made by the point of the dibble in the earth; when, by moving backwards and forwards the cross handles *g g*, fixed on the top of the hollow stave, the soil surrounding the hole in the earth is loosened by the iron wings *f f*, and deposited on the acorn. *Fig.* 3, *h*, shows

3 

a section of the iron wings *f f* belonging to the bottom of the hollow stave.

"Supposing that you wish to plant an acorn in the middle of any bush, you are to press the instrument through it into the ground, make a hole in the earth by the point of the dibble rod, then raise the rod above the hole where the two tubes communicate, drop the acorn down the tube *b*, which falls immediately through it and the lower part of the stave tube into the hole previously made by the rod, which hole is instantly covered by the soil raised by the wings. The dibble rod may be occasionally passed down the metal tube, to be certain of its being perfectly clear."

The *addition* might be a cup at the top to contain the grain to be dibbled; and it should be so constructed, that the act of withdrawing the dibble from the ground should cause the necessary seed to fall into the tube, and along that channel to its destination. The iron wings may, probably, be unnecessary for grain.

I am, dear Sir, your's, &c. &c.

JOSEPH JOPLING.

24, *Somerset Street, Aug.* 8, 1827.

ON HEAT, AND ITS ECONOMICAL APPLICATION TO THE CONVERSION OF FLUIDS INTO STEAM.

BY MR. W. GILMAN, CIVIL ENGINEER.

(*Concluded from page* 136.)

Having extended this paper to a considerable length, I will now conclude with an observation or two on steam.

Vapour has been supposed to require the same quantity of heat, whatever may be its temperature; *high* temperature being thought to be merely the result of concentrated or more dense vapour, rather than of any increase of the matter of heat itself. This theory, however, may be questioned: for, having produced steam of two hundred pounds per inch, in a vessel where the surface of the water was measured by a very sensible float; and then, by opening the safety-valve, allowed the steam to escape; the water sunk at least

six inches during the operation, and exactly in proportion to the decrease of pressure as exhibited by the indicator. Thus, that portion of water which could not become steam at 200 pounds an inch, was sufficiently charged with heat to self-generate at 150; that of 150 to become steam at 100; and that of 100 at 50; and so on. This, too, was the case, whatever interval was allowed to elapse for its generation between each escape. Now, if vapour or steam did always absorb the same quantity of heat in its formation, this effect of self-generating, I apprehend, could not have occurred; for the particles that had received sufficient heat could not have remained in the state of water, and formed strata in the upper part of that body, but must have separated from it through its specific lightness, and become steam of any degree of density inferior to that of the water, and greater or less, in proportion to the size of the chamber and the quantity of water that had received its proper charge. Were this correct, water would not receive any great increase of temperature, because it would be carried off by the particles continually separating from it; and we should have this curious phenomenon, when a fluid is undergoing a change of form, that that part becoming elastic, would exhibit, perhaps, many hundred degrees of heat, while the body from which it separated remained comparatively cold. This, however, is an anomaly which could not exist. Hence it must be inferred, that "all vapours and steams absorb the same quantity of heat in their formation under the same *pressure*, and that they require more heat as the *pressure* increases;" for it is necessary to the effective existence of a heated particle, rising, by its specific lightness, through the body of a fluid from the bottom whence it received its charge, that such fluid should be of such temperature as not to abstract its heat; and though the particles passing up through, and the body of the fluid, should exhibit the same degree of temperature, yet they possess very different quantities of heat; and therefore the particles of the body of the fluid cannot become vapour of an elasticity equal to that of those particles rising through it; consequently, these particles still retain their original state.

This circumstance effectually prevents the water in the tubes, subject to the minor heat of flues, from being generated therein: for the water exposed to the fire will ever be of superior temperature; and though the water in the tubes might be heated to a degree sufficient to become steam of less mechanical force, yet it will be prevented as effectually from so doing, as if there were a valve or any other transfer apparatus between it and the water in the boiler over the fire,—a circumstance which greatly simplifies tubular arrangements.

In using steam, there are two modifications of applying its power: that of allowing it to flow to the working cylinder from the boiler or generator, from the commencement to the termination of the stroke; and that of cutting it off when the piston has passed through some determined distance. When using steam in the latter mode, suppose at 40 pounds per inch, in a cylinder whose piston is of $7\frac{1}{2}$ inches area, and making a stroke 36 inches long; on deducting the resistance of the atmosphere against the piston, there will remain effective 25 pounds an inch. Thus, $25 \times 7\frac{1}{2} = 187\frac{1}{2}$ against the whole area; then $187\frac{1}{2} \times 36 = 6750$ pounds, the aggregate effect of the stroke one inch high. Now, if the same quantity of steam be used, but in the concentrated form of 300 pounds an inch, a piston will be only required of one inch area, making the same length of stroke as before. On deducting the resistance of the atmosphere, there will be left effective 285 pounds. $285 \times 36 = 10260$ pounds one inch high. By using the like quantity of steam expansively, the following will be the effect:—Suppose four expansions, and the area of the piston one inch length of stroke, as before, the mean force of the steam will be about 176 pounds; allowing for atmospheric resistance, this will

leave effective 161 pounds: but as the cylinder is only one quarter filled each stroke, the quantity of steam expended each stroke will be only 1-4th of that in the above examples. Hence, $161 \times 4 = 644 \times 36 = 23184$ pounds one inch high. From eight expansions the following will be the effect:—Mean force, 113 pounds; effective, 98 pounds = 1-8th of the steam used each stroke; then $98 \times 8 = 784 \times 36 = 28224$ pounds one inch high.

Therefore, by using the same quantity of steam as in the above example, the effective power will stand thus:—

Flowing during the whole Stroke.		*Expansively.*	
40 pounds per inch	300 pounds per inch	4 expansions 300 pounds	8 expansions 300 pounds
6750	10260	23184	28224

These calculations are made upon the supposition that the power of steam, when acting expansively, is in the inverse ratio to its increase in bulk. Using steam of 300 pounds an inch, produces a saving of more than one-third, by reason of the reduction in the resistance of the atmosphere from contracting the area of the piston, as compared to that of steam when used of 40 pounds an inch. But if steam be used of higher pressure in this mode, little further profit can be obtained; as the saving afterwards would only amount to the friction of an atmosphere. For instance, were the power of the steam to be doubled, or 600 pounds, the saving would be only 7 pounds an inch; which would by no means compensate for the waste of fuel occasioned by generating steam of great temperatures, as has before been shown.

From steam acting expansively, it will be seen that by far the greatest profit results; but it is questionable whether the saving will be of much importance beyond six or eight expansions, as the increments of profit then become small.

The construction of an engine need not be confined to two cylinders, as represented in Number 205, nor should I recommend them, excepting under circumstances where expansive action is carried to a great extent; for it is by no means desirable to increase the number of working parts, particularly those that are most liable to get out of order.

The framing is equally adapted for either one or two cylinders; and this form of construction affords any desirable length of stroke, and at the same time an ample length of side rods connecting the shaft.

Little knowledge has been obtained of steam of any practical importance since the time of Mr. Watt and Professor Robison, as may be ascertained by referring to their experiments. Nor will the subject, probably, afford much further information of real practical utility. Mr. Watt saw the value of using steam expansively; but the method of constructing boilers, and the deficiency of workmanship in his day, could not furnish him with the necessary vessels, connexions, and other requisite means, to enable him to apply the principle either advantageously or safely, even if he ever entertained the idea of carrying the pressure of steam to the extent we now do. That which can be now effected with perfect safety, dared not even be contemplated in his time. All, however, he left to be accomplished, was the discovery and the constructing of proper means to furnish steam of high powers, and a judicious application of heat to effect it most profitably.

W. Gilman.

London,
25th July, 1827.

IMPROVEMENT IN PADDLE WHEELS.

Sir,—Having, in the various trips I have taken by steam vessels, been led to think that the back water from the paddle wheels much retarded the way of the vessel, I was induced to be very attentive in my observations. The exercise of swimming, which, by the action of the hands, has a tendency both to remove the water from before the body, and also to throw the back water from (and not against it), suggested to me, that if the paddle wheels could, by being fixed on two shafts instead of one, be thrown forward, say about 10 or 15 degrees, both forming an angle of from 140 to 160 degrees, they would by their action clear off the water more from the head of the vessel, and also prevent the back water impeding its course; and I should be much disappointed if the alteration did not make an increase in the speed of the vessel of one mile in ten.

Since thinking upon the above, I have noticed that one of the fastest steam vessels, lately started, is built much narrower aft of the paddle wheels; by which the effect of the back water is in a great measure removed; and to this circumstance I am convinced it is in no small degree indebted for its superiority in going,—a fact which tends to confirm me in the opinion above stated.

It may be objected, that by having two shafts (detached), should any thing occur to stop one of the engines from working, only for a short time, one paddle wheel only could work, and that this would send the vessel round. To this I answer, if only one engine works, of course one half of the power is lost; therefore, to prevent the vessel going round, I would have a bevil on the inner end of each shaft—one fixed, the other made to shift; I would have a train of two wheels to run in the fixed wheel; and should it be wanted to throw all the work on one engine, let the shifting wheel be forced to its bearing, and the two train wheels will unite the two shafts in action, for the temporary purpose; or the two train wheels may run on a shifting bar, and be put in action only when wanted; (this action I have many years ago applied to clock machinery; and in this manner no more power will be lost than arises from the friction of the train wheels); or two bevil wheels, one fixed on the inner end of each shaft, would, in a very simple way, connect and render their action as that of one shaft.

Should you think this worthy of insertion in your useful Magazine, it will, (with the hope that it may eventually prove beneficial) oblige,

Sir,

Your obedient Servant,

T. S. STEPHENSON.

A Subscriber from the Commencement.

Hoxton, August 7, 1827.

STEAM VESSEL RUDDERS.

Sir,—From the great length of steam vessels, with the powerful resistance from the paddles, the large circle which they take in coming round has been the cause of numerous accidents, and the loss of many valued lives. Permit me, through your extensive medium, to inform those who are connected with steam vessels, that I have constructed two additional rudders, by which they may be brought round almost within their own circle. Should this information be considered of any moment to those extensively connected with steam vessels, so as to dispose them to make a trial, or to wish information as to the principles on which these rudders act, by applying to the Editor of the Mechanics' Magazine, they will procure my address; when a letter, post-paid, will meet the earliest attention, and I will forward them a drawing or model for their inspection, free from charge.

N.

CAOUTCHOUC HOSE.

Sir,—An interesting experiment took place on board the powerful floating engine belonging to the London Assurance Corporation, a

few days since, in presence of the Directors, to ascertain the strength of a newly-invented hose, made of caoutchouc, or Indian rubber.

A length of leather hose and one of Indian rubber were attached to the engine, each furnished with a branch tightly corked. On working the engine for a short time, the *leather hose*, unable any longer to resist the accumulated pressure, burst in the solid part of the leather; while the Indian rubber hose remained firm and uninjured; and the engine itself became disabled, by the breaking of one of its cranks, without producing any effect upon the elastic material of which the new hose is constructed. The Norwich Union Society's engine is provided with these hose, and used them at the late calamitous fire at Fresh Wharf. The greatest advantage will be derived by the general adoption of the caoutchouc hose, in lieu of leather; but they cannot be laid across *hot ruins*.

I remain,
Your's, respectfully,
WM. BADDELEY, Jun.
10, *George Yard, Lombard-street,*
Sep. 10, 1827.

LONDON MECHANICS' INSTITUTION.

NO. X.

" Semper fidelis."

Lectures.

Wednesday, August 1.—Mr. Preston, a member, commenced a Course of Lectures on Optics.

Friday, 3.—Mr. Brayley on the Anatomy and Physiology of Invertebrate Animals.

Wednesday, 8.—Mr. Preston on Optics.

Friday, 10.—Mr. Brayley in continuation.

Wednesday, 15.—Mr. Preston in continuation.

Friday, 17.—Mr. Brayley.

Wednesday, 22.—Mr. Preston.

Friday, 24.—Mr. Brayley's concluding Lecture on the Anatomy and Physiology of Invertebrate Animals.

Wednesday, 29.—Mr. Preston's fifth and last Lecture on Optics.

Tuesday, Sept. 5.—The following 15 Committeemen were elected to serve for the year next ensuing.

Not of the Working Class: Messrs. Holtzapffel, Blake, Lane, Richard Taylor, and Mason.

Of the Working Class: Messrs. Christie, Gowland, Lyne, Wood, Piggott, Hough, Langston, Hackett, Eardley, Nicholls.

There were nine candidates of the former, and eighteen of the latter class.

Quarterly General Meeting.

Sept. 6, 1827.—Dr. Birkbeck in the Chair.

The minutes of the last year having been read and confirmed, the Secretary proceeded to read the Report of the Committee for the last quarter; which, after a few introductory remarks, introduced the following statement of the cash accounts:—

	£.	s.	d.
Balance in hand at the end of last quarter . . .	56	12	11
Amount received during the quarter	458	4	9
	514	17	8
Disbursements	439	16	9
Balance . . .	75	0	11

The principal items in the receipts were —Members' subscriptions, 320*l.* 16*s.* 6*d.*; transferable tickets, 5*l.* 14*s.*; donations, 22*l.* The chief disbursements were for lectures, interest on debt of 3700*l.*, wages, &c. &c. During this quarter, a further reduction had taken place in the tradesmen's bills.

The Report then proceeded to notice the state of the finances. Payments to the amount of 150*l.* not belonging to the usual expenses of the Institution, had been made, while the debts incurred do not exceed 130*l.*: this improvement is attributed to the gratuitous Lectures which have so liberally been given during the last half-year.

The Report announced that the number of members had decreased. The amount of the subscriptions, however, was not lower, but exceeded those of the corresponding quarter during last year; and the expenditure had diminished 40*l.*

The two principal donors were John Melville, Esq. 10*l.*, and J. W. Goodwyn, Esq. 10*l.* 10*s.*

Then followed the list of books, apparatus, and gratuitous services in work, which have been presented during the last quarter. The number of volumes presented were 170, and pamphlets 50. Several specimens of minerals; tools from Mr. Holtzaffel, value 8*l.* 8*s.*; the skeleton of an adult male from Mr. W. Coulson, &c.

After acknowledgments to the school-masters, the Report proceeded to notice the lectures, viz. Dr. Birkbeck's on anatomy, and which are to be extended to the functions of the body; also those of Messrs. Brayley, Stone, Preston, Dr. Mitchell, and others. Three honorary members have been added, viz. Messrs. Goodwyn, Melville, and Brayley.

After some remarks on the lectures and weekly meetings, the Report gave the following as the number of members, during the past quarter:—383 members have ceased paying; 192 new ones have entered, and 13 paid up arrears. The total number on the 20th of August last, was 1067, including 14 sons and apprentices of members.

Several alterations have taken place in the school department. A class for the study of practical geometry has been opened, under the gratuitous care of Mr. H. Poole, whose attention to it is worthy of the highest praise.

The Monday and Tuesday classes, under Mr. Davy, have been united; so that he attends to one on Thursdays, and now all are accommodated who have applied for instruction in drawing.

A class for instruction in English grammar has been formed; and one for mutual instruction in the more simple elements of grammar, is about to be opened. The French class, under Mr. Dufief, continues to flourish.

Mr. Downes will shortly deliver two Lectures on the Application of Magnetism to Navigation, and the means of determining the longitude of places.

Professor Millington will also deliver a gratuitous course of Lectures on Hydrostatics and Hydraulics—(*loud applause*).

The Report, after calling the attention of the members to the prize offered by Dr. Fellowes, and announcing that the Vice-Presidents offered a silver medal for the best perspective drawing of Mr. Lyne's comb-cutting machine, to be competed for by the drawing classes, and to be delivered in by the 1st of November, concluded by pressing the members, as they had formerly done, to avail themselves of mutual communication, as the best means of affording permanency and prosperity to the Institution.

The Report was received throughout with considerable applause; and after having been received without an opposing voice, W. Ellis, Esq. laid before the Meeting the Report of the Auditors on the accounts during the last six months, which was unanimously received.

The following proposition for altering the law for admission of honorary members, was then put and carried:

"That those who have been members for twenty years, shall be honorary; and that those who contributed £15 value in labour, should also be honorary members, subject to the usual restrictions."

Mr. Gloyn then addressed the meeting on the falling off in the numbers, which he attributed to the increase of subscription money, the half crown admission, and the indifferent lectures which have lately engaged the attention of the members. He suggested the necessity of some plan by which to recruit the strength of the Institution. A discussion of some length followed, in which Professor Millington, Mr. M'William, Mr. Lane, and several members, joined. The latter gentleman proposed that a school for instructing the sons and apprentices of members in the day-time should be established; and Mr. Gloyn very handsomely offered his gratuitous services from four to six, should the suggestion be carried into effect. Nothing definite, however, was determined upon.

Unanimous votes of thanks were passed to the various gentlemen mentioned in the Report, and to Dr. Birkbeck for his conduct as Chairman. Dr. Birkbeck, in a neat speech, which was loudly cheered, returned thanks; and having retired, the meeting separated at a late hour.

The Report of the meeting, &c. having taken up so much space, I shall reserve my remarks thereon for my next number of the Chronicle.

I am surprised that any one should charge me with having stated an untruth in what I wrote respecting Mr. Dowling. The "Constant Reader" was either asleep or deaf, but the gratuitous support I have received must have convinced every one of the truth of my report. I trust that I shall never go out of the path of rectitude for the mere purpose of uttering a wanton falsehood.

I am, &c.

NOTICES TO CORRESPONDENTS.

The continuation of the article on "Pricking Music on Clock Barrels," and Mr. Harris on "Lightning Conductors," are unavoidably deferred till our next.

Communications received from Mr. Russell—T. C.—A Constant Reader—F.—W. C.—An Amateur Bookbinder—Noah—H. Johnson—?—Mr. Shires—B.—Philomath—J. S. [illegible]—Mr. Cox.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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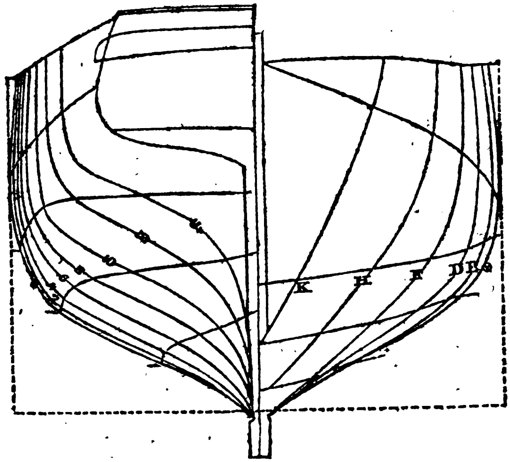
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 214.] SATURDAY, SEPTEMBER 29, 1827. [Price 3*d*.

DESIGNS FOR A REGATTA YACHT, AND MERCHANT VESSEL.

1.



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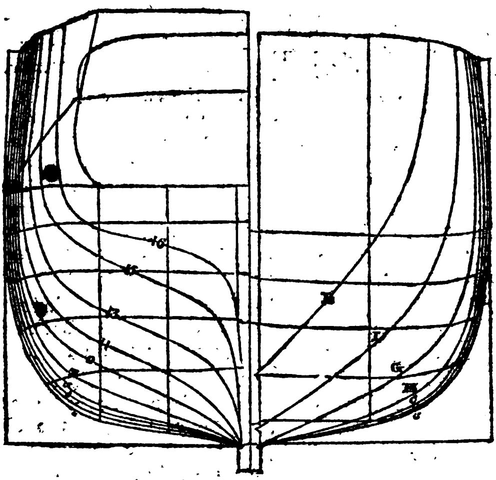


DESIGNS FOR A REGATTA YACHT, AND MERCHANT VESSEL; AND NEW METHOD OF SECURING RUDDERS WITHOUT PINTLES OR BRACES.

Mr. Editor,—Your correspondent G. B., of Ipswich, in page 269 of your 192d Number, has asked a most strange question as to the best form for the bow of a vessel, without giving a midship section; which, he says, is to be done by omitting the tedious calculations of the fore and after bodies. Now, I have no hesitation in saying this is a complete fallacy. It reminds me of Munchausen's horse, continuing his course through a town when his hinder part was left without the gate. The great art in constructing a vessel consists in equalizing of the fore and after bodies; and every thing, as it respects her qualifications, depends on the true point for the centre of gravity. There are such things as monsters in architecture, as well as in nature; and no man would think of forming the bow of a vessel first, unless he were about to adopt the practice imputed many years since to the ship-builders of a certain place in the west of England, that they built their vessels *by streets*, so that purchasers could have any length cut off to suit their purpose.

Had I no other motive than to answer the foolish question of your correspondent, I should have remained silent; but the question, in connexion with the other parts of a vessel, being important, and feeling a great anxiety for the usefulness of your work, I am induced to state to your readers, that the bow of a vessel should be so formed, that the centre of gravity should always (let your vessel be either for passage or burthen) fall a little on the aft side of her half-length at the line of floatation; taking all possible care this is not effected by throwing out your lower water lines aft, but by swelling out your upper lines to the greatest possible breadth on the quarter. Very few shipbuilders have time or experience sufficient to analyze ships on the principles of geometry, although this is much to be desired, and of great advantage to those who have the means. Hence it was I commenced my correspondence with you, as an advocate for modelling; because this is within the reach of every capacity, and is after all the plainest, safest, and most correct system that can be followed. I am really at a loss to imagine how any person, capable of constructing a vessel, should say there is difficulty in the performance. A young beginner will derive more information from the rough models of a cant, or counter timber, fashion piece, or transom, which will not take four hours to form, than from a whole year spent in copying the best drawings he can procure.

The better to accomplish the end I have in view, I have with this sent you two sets of drawings: one (fig. 1 and fig. 1 A) of a small yacht under 12 tons, on a quarter scale, constructed for fast sailing, with a new method for securing the rudder, without pintles or braces; the other (fig. 2; fig. 2 B; fig. 2 C) of a merchant vessel of 110 tons, on an eighth scale, being a class of vessels much in use in this country. I have, to keep the expense of engraving within bounds, introduced only the material parts, leaving the rest to be filled up by those who may approve of the drawings.

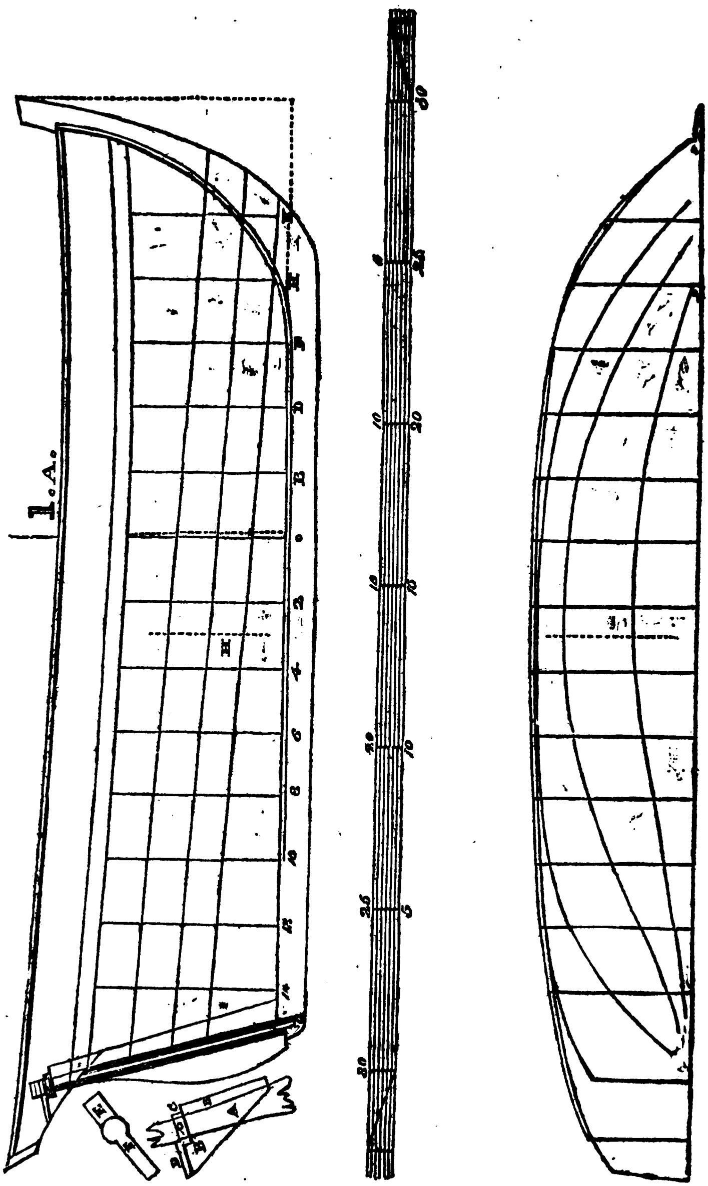
A (fig. 1 A) represents a section of the rudder in the case.

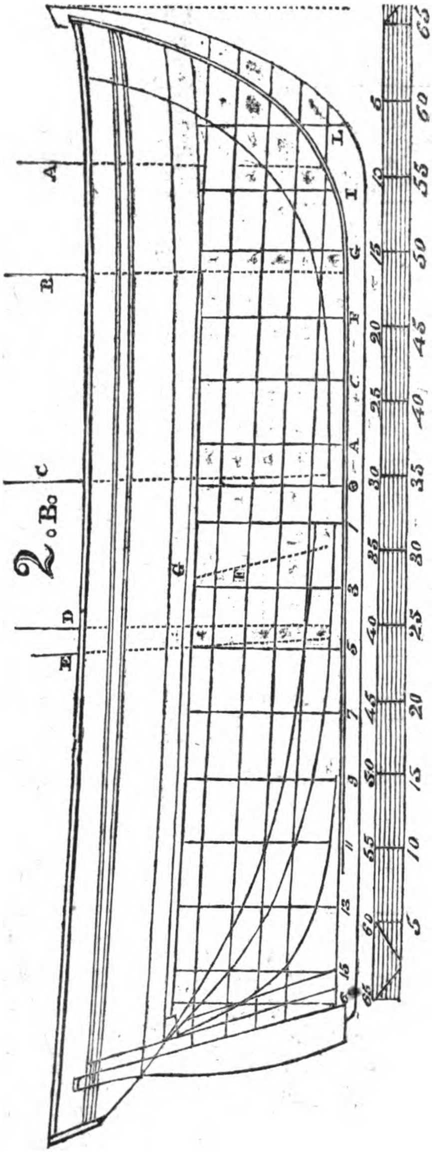
B B the case or chock, which is to be securely fixed between the two centre counter timbers, the after part to be flush with the counter; this chock is to have a circular hole, which is to merely fit round the head of the rudder, so as the rudder may work in it with as little play as possible.

C an iron hoop, of three-eighths of an inch thick on the after part, which is to be put on when the rudder is in place.

D an iron plate, to be secured on the upper part of the chock, to fit round the rudder, resting on the hoop to prevent it from lifting.

E an horizontal section of the post.





F a section of the rudder, and the manner of its working in the posts, which must have a circular groove from end to end.

G the heel of the rudder, with the spindle and round mortice in the keel for the rudder to work in.

H the centre of gravity, and greatest transverse section.

(Fig. 2; fig. 2 B; fig. 2 C) A and D represent centres of the masts for a brig.

B and C centres of the masts for a schooner.

C centre of the mast for a smack.

F centre of gravity when light, and greatest transverse section.

G centre of gravity when loaded.

H centre of gravity when under a press of canvas, with the point * in the water.

11 to 55, on the transverse lines, show the centres of gravity on each section.

In order to show with what ease models may be executed, I have also in these drawings laid off separately the water lines in five sections, (as 1111 to 5555) with their thickness at the extreme breadth. The modeller has only to transfer these five water lines on a quarter, or half-inch scale, to a clean sheet of paper, and when done to fit five pieces of fir to the form laid down; which, when glued together and cleaned off, will form an exact representation of your vessel from the load line downward. The upper-works not being essential, all that need be added is the half of the keel, stem, and post, to the height of the load line. *To find the centre of gravity*, take two pins, fix the points on each side square across, and at the points where your model becomes at rest, with the upper surface horizontal, is the true centre of gravity at the load line, when your vessel is swimming upright. For it must be understood, the body being moveable and variable in form, the centre of gravity, as you lighten her, will pass forward, (see the centres of gravity at the different water lines on the drawing;) and at different degrees of heeling, under canvas, it passes aft towards the point of pressure. To find her *specific gravity*, if your model is on a quarter scale, get a piece of fir of the same whereof your model was made, square it up 2 inches by 3 inches, and 10½ inches long; if on a half inch scale, let your piece be 5 inches square, and 20½ inches in length: your model, if correctly made, will be equal in weight to one of those pieces, which at their respective scales will be equal to 4025 square feet: double this, to make good the two sides of your vessel, your displacement will be 8050 square feet; taking a square foot of water at 62½ lbs., your vessel with her cargo will be 224 tons. *To get the weight of your vessel*, with all her rigging and stores, when she is completely equipped for sea, with a clean hold, mark very nicely her draft of water, forward and aft, on the post and stem; weigh in her cargo very exactly, and at every 10 tons mark in the same manner, continuing so to do till she is down to her load line, by which time there will be say 150 tons; the weight of the vessel with her stores will be 74 tons.* Enter all these particulars into a book: the master will, then, always have the means of knowing the exact weight of her different cargoes, with the quantity of ballast at all times put on board. You will, also, be enabled to see her increase of weight, from age, or other causes. No calculations, however nice, will furnish you with so correct a method. Were owners of vessels to pursue this simple and easy plan, they would find it turn to account.

I am, Sir,

Your very humble Servant,

NOAH.†

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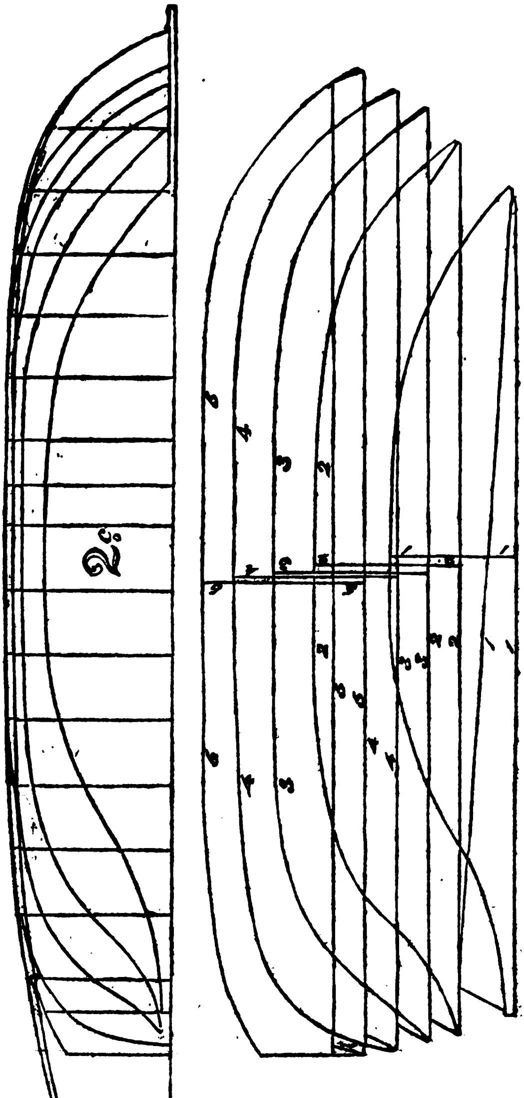
* It is more than probable that I have exceeded the weight of the vessel and her stores, 10 tons; if so, she will carry 160 tons, when down to her load line.

† Reply by Philo-Naut. to Noah's former paper in our next.



REID'S APPARATUS FOR PRICKING MUSIC ON CLOCK-BARRELS.

(*Concluded from page* 132.)

After one tune is laid on the barrel, either the barrel, or what is, perhaps, preferable, the music scale, must be shifted a short space when the next tune is to be put on. The spaces for shifting should be marked on the top of one of the supports, and close by one end of the long slip of brass; or they may be marked on a short line drawn longitudinally on the surface of the barrel, at or towards one of the ends of it; or, by taking both methods, the one would serve as a check on the other. The *length* of shifting depends on the distance between the hammer-tails, and the number of tunes to be put on the barrel. For example: if the distance between the hammer-tails is four tenths of an inch, and it is proposed to put eight tunes on the barrel, then, if we divide four tenths by eight, we shall have half a tenth for the length, or space to shift for each time; and this is taking advantage of the whole space between the hammer-tails,—a circumstance frequently overlooked; for where the shifts have been confined to a less space for shifting than might have been got, so much room is lost. The distance between the hammer-tails depends on their number, and on the length of the barrel. Mr. Reid has made the distance a quarter of an inch, where the number of hammers was eleven; the length of barrel about three inches and a quarter; the number of tunes put on the barrel seven; the spaces for shifting three hundredth parts of an inch, or thereabouts; and where the clock of itself shifted the tune. The diameter of the lifting pins must also be taken into account, being of some consideration where the spaces for shifting are extremely limited.

Although the number of the wheel-teeth for dividing the notes has been taken at 250, yet either a greater or less number may be assumed: all that is required, is to proportion the number of turns of the endless screw, and parts of a turn, to the number of bars in the tune; to the notes in each bar; and to have the tunes to go nearly round the barrel, so that a small part of a revolution of it, after the tune is played over, may be left for what is called locking and running.

When the tunes are all marked on the barrel, each mark must be drilled. Great care should be taken to have a stiff and excellent drill, so as to run no risk of breaking; and it should be of such a temper, and so well and judiciously whetted up, that it may drill all the holes without requiring to be once sharpened: the object here is to have all the holes of the same width.

The holes being drilled, and the barrel polished, a number of pins should be prepared into lengths of half an inch or so each, and a very little tapered at one end. The stronger and harder the brass wire for the pins is, so much the better; some of the best kind of pins used in the female dress are very fit for this purpose. In placing the pins in the holes, if they should be found too long for knocking in by the hammer, they should be shortened by the cutting plyers before the hammer is applied, which will prevent bending, and allow the pins to have a more secure hold of the barrel rim.

After all the pins are put in, they must be shortened to an equal and proper length or height. For this purpose prepare a hard cylindrical steel collet, having a hole in its centre sufficiently wide to allow it to be put readily on the pins; the lower end of it hollowed, the upper end rounded, and the height of the collet about one twentieth of an inch, or a little more; the height depending on the size of the barrel and the diameter of the pins. The collet being placed on a pin, the cutting plyers are applied, to cut the pin just over by the rounded end; a small touch of a file takes away the burr made by cutting, and as the hardness of the collet prevents the file from taking any more away from the height of one pin than from another, they must all be of equal height. The small burrs made on the top of the pins by the file must next be taken off; which is done by a piece of steel wire, about six or seven inches long. The end where it is whirled about by the fore finger and thumb, should, for the length of an inch or so, be made into an octangular form, for the more readily turning it round, backward, and forward. On the face or point of the other end two notches are made across each other, which may be either angular or round at bottom. The point where the notches are cut should be hardened, and the inside and bottom of the notches polished; so that a sharpness may be given, to take away the burrs easily from the tops of the pins.

The shape of the hammer tail is such as is represented at fig. 4 (p. 131); a form which makes the hammer easy enough to be drawn. The nib of the tail, too, takes little or no room when falling, and should two pins or notes succeed each other rapidly, the nib will not be interrupted by the succeeding pin.

In the *first musical clocks*, and even in those made long afterwards, the bells were all placed on one strong iron bell-stud, the opposite end of which was supported by what may be called an auxiliary stud, which occasioned a crampness that prevented the bells, when they were struck, from vibrating or giving out that full tone which they might otherwise have been made to produce; and the improvement afterwards made on this, as well as on the quarter bell-studs, was effected by placing each bell separately on its own bell-stud, which was made of well-hammered brass, having some degree of elasticity. The sweetness given to the tone of the bells, by this method, was truly surprising.

The bells, in this kind of music, may be sounding at the time that a succeeding note is struck out and sounding too, which may not be so pleasant to a very nice ear. This can be prevented by having a double set of hammers, and having every tune pricked twice over on the barrel; one set of the hammers having the heads of buff leather, or having brass heads, with pieces of cloth sewed over them. These, when they strike the bell, will damp the sound of the note which is last struck. The buff hammer should fall on the bell to be damped, at the same instant that the brass hammer strikes the succeeding note on its bell. This improvement, however, must greatly increase the expense of such a clock; but the effect of buff or cloth hammers is so striking, that the additional price ought not to be grudged.

In fig. 4 (p. 131), A A is a circle, representing an end view of a clock music barrel, and a few of the lifting pins. The dart shows the direction in which it turns. The letters *a a a a* represent a section or end view of the brass piece called the hammer-frame. The length depends on that of the barrel, and the number of hammers to be let into this brass piece; it is sometimes 3 or 4 inches, sometimes 10 or 12. The flat part of the hammer-tails fills up the thick part of the hammer-frame, into which slits are made to receive the hammers. Near to the outer and lower angular part at *a* of the frame, a hole *h* is made through the whole length of it; not drilled, but ploughed (as the workmen term it), and this is done before any slits are made in it for the hammers. A wire is put through this hole, and through corresponding holes in the flat part of the hammer-tails. This wire is their centre of motion, and the holes in them are made so as to have freedom on it; and the flat parts of the hammer-tails are also made to have freedom on the slits made to receive them. On the under side of the hammer-frame, at *b*, the hammer-springs *c c* are screwed, one for each hammer, acting on that part of the hammer-tail just where it comes out of the thick part of the hammer-frame. When the pins in the barrel raise up any hammer by the nib, and carry it away from the bell, at the instant the pin quits the nib, the spring *c c*, by its returning force, makes the hammer-head give a blow on the bell to elicit the sound. To prevent any jarring in the bell by the hammer-head resting on or touching it, after having given the blow, each hammer has a counter spring acting near the lower end of the shank and inside of it. All the counter springs are made to project from one slip of well-hammered brass, and screwed on the top of three kneed brass cocks, fixed to the upper side of the brass frame. *d d* represent the side of one of the cocks; *e e* an edge view of one of the counter springs; *f f* a side view of one of the bell-studs, which are also screwed on the upper side of the hammer-frame; *g* an edge view of the bells; *g*, fig. 3 (p. 130), a side view of the bells, as fixed to their studs.

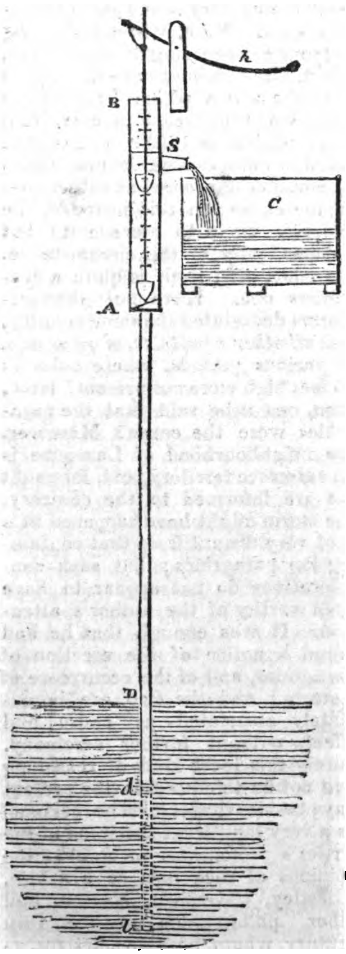
The apparatus which has been thus fully described, for marking the tunes on clock barrels, is stated by Mr. Reid, "to be equally suited to do the same on barrels intended by machinery to work or to sound the pipes of an organ; the difference consisting in marking off on the barrel the spaces of the longer and shorter notes, as, in place of pins, they have staples or bridges of various lengths, according to the length of the note or the time which the pipe should be allowed to sound it."

IMPORTANT IMPROVEMENT IN STEAM-BOATS.

Mr. Roentger, builder to the Netherlands Steam-boat Company at Rotterdam, is stated in the Dutch papers to have succeeded in effecting an improvement in the position of the paddles of steam-vessels, "which the English, French, and Americans, have considered to be

impracticable." The wheels are placed, "*not on the sides, but behind.*" A vessel thus constructed, for the purpose of plying between Ghent and Antwerp, arrived at the former city on the 10th of September last, and is said to "give great satisfaction, both by the rapidity of its progress, and the facility with which it is managed."

PNEUMATIC AND HYDRAULIC INQUIRY.



Sir,—Having been a constant subscriber to your valuable repository of mechanical science, I am requested by some friends to beg the favour of the insertion of the following questions relative to the construction of pumps.

A B, in the annexed diagram, exhibits a pump newly erected for the convenience of drawing water to fill a cistern situate at C.

D S, height of spout from the surface of a stream, which is about 30 feet.

D A, length of pipe 26 feet.

D *d*, depth of pipe under the surface, 1 foot.

Internal diameter of the pump, 4 inches.

Do. do. of lower pipe, 2 inches.

Under these circumstances, the operation of working the pump is attended with several *inconveniences;* namely, the sudden snatching or jerking of the pump rod, when acted on by the handle *h*, and the great labour required to obtain water. It has been suggested, that if a well or hole were sunk immediately under the immersed pipe D *d*, in the middle of the stream, say to the depth of 4 feet, and an additional length of pipe be added, as *d l*, so as to increase the length of pipe in the fluid, (the surface of the water remaining always the same,) the pump A B would be worked with greater ease, and prevent the present inconvenience.

From this statement of the case in hand, two or three questions naturally present themselves. First, whether the proposed alteration will produce the desirable end or not. If not, what will be the best mode of constructing the pump? and what proportion of diameters and lengths, in reference to the pump and its leading pipe, would be requisite? As these particulars are not questions of mere curiosity, but of general utility to mechanics unacquainted with pump work, a mathematical, philosophical, and practical evidence of the best method of remedying the defects, by some of your more intelligent correspondents, as early as possible, will gratify the inquirers, and at the

same time confer a lasting obligation on,

Sir, your obliged Servant,
H. FOORD.

Sandwich,
July 13*th*, 1827.

LIGHTNING CONDUCTORS.

Sir,—It is not my desire to attribute any unworthy motive to the author of the letter on lightning conductors, which has lately appeared in the 204th Number of your valuable journal; but I trust I may be allowed to complain, as a humble inquirer after truth, of the extraordinary misrepresentations contained in that communication. The statements, unsupported as they are by facts, do not really possess much claim to consideration; but they have been honoured by a place in one of the most respectable and widely circulated scientific journals of the day, and therefore it is but fair that their fallacy should be exposed through the same channel of communication. Although Lieut. Green's statements concerning lightning conductors have been repeatedly shown to be at variance with facts, and not warranted by any scientific deduction, yet he again and again presses them on the public attention, as if they were perfectly new, and as if no such refutations had ever appeared.

In his communication abovementioned, he states, that hundreds of conductors, armed with points, are attached to His Majesty's fleet, at Plymouth, *for the purpose of experiment;* that such conductors are calculated to bring *destruction on the fleet;* that such destruction as foreseen by him would take place at the time of firing a gun, and that unheard-of convulsions would be the consequence; that the churches at Plymouth would also, from a similar cause, be one day knocked down about the ears of the people; and finally, that phenomena have occurred in Plymouth and France which confirm these wonderful predictions.

Loose extracts from the public prints have been referred to for the purpose of substantiating some of these assertions. I am ready to admit the evidence, being prepared to show that it does not warrant any one of them.

We have first a quotation from a letter written in the YEAR 1825, stating, that the country in the neighbourhood of Lausanne was AT THAT TIME UNDERGOING a singular process called paragrèling; and, secondly, a quotation from a paper dated in THE YEAR 1824, that is to say at a preceding period, which states that a severe storm had desolated the country in the same neighbourhood. Now, without stopping to inquire concerning dates or places, Lieut. Green would have it inferred that the storm which *happened in* 1824, was produced by the erection of paragrèles *in* 1825! It has been usual in philosophical investigations to consider the effect as subsequent to the cause; in this instance, the effect is made to precede it: but independently of this circumstance, the conclusion itself is quite a gratuitous one. Have not thunderstorms devastated the same country, and *all other countries, more or less*, at various periods, where poles of 40 feet high were not present? How, then, can it be said that the paragrèles were the cause? Moreover, the neighbourhood of Lausanne is an extensive territory, and, for aught we are informed to the contrary, the storm might have happened at a spot very distant from that containing the paragrèles; but such considerations do not appear to have been worthy of the author's attention. It was enough that he had found a notice of the erection of paragrèles, and of the occurrence of a storm; and the two are immediately associated as cause and effect, without further ceremony. Surely this loose kind of reasoning will not be tolerated in the present day; besides that it must be reckoned as a very indifferent specimen of the writer's pretensions to combat the opinions of such men as Franklin, Priestley, Cavendish, Watson, and other philosophers of the 18th century, whom he characterizes as men "who have only taken fancy and theory as their guides."

The conductors were not applied to the fleet at Plymouth, as Lieut. Green states, "by way of experiment;" but as recommended by Dr. Watson, who proposed the measure in a very able letter to the Hon. Lord Anson, so long since as the year 1762; an account of which is to be seen in the "Philosophical Transactions" of that period: which letter appears to have had so much weight with his Majesty's Government, that conductors have ever since been directed to be so applied.

The utility of the application was fully shown in the year 1824, when a heavy thunder-cloud passed down the harbour over the ships thus equipped with conductors, and likewise over a powder-magazine, also fitted with conductors, and without doing the least damage to either: a little further to leeward the lightning struck a 74-gun ship, the Milford, which HAD NOT A CONDUCTOR, and did considerable damage. Thus the assertion of Lieut. Green is in direct opposition to the fact.* It will be proper here to observe, that this thunder-storm did not occur at the time of firing a salute, nor is there the least trace of such a coincidence having ever occurred at Plymouth.

The last quotation is an unfair extract from a letter inserted in the Plymouth Chronicle, by a gentleman of Plymouth, in order to prove the great utility of lightning conductors as a defence against atmospheric electricity. The damage described does not relate to the church, but to a small temporary shed at the foot of the tower, in which the conductor improperly terminated;† all the preceding part of the letter, describing the protection of the church and tower, by the conductor, is kept out of sight. In this attempt to make it appear that the damage received by the temporary shed at the foot of the tower, had been inflicted on the church itself, so as to bear out the previous prediction that it would be "knocked down about the ears of the people," Lieut. Green has departed from that dispassionate and candid spirit of inquiry which should characterize every one engaged in a philosophical research. The Plymouth church, *instead of being knocked down about the ears of the people, was not in the slightest degree damaged*—not a pane of glass was broken; on the contrary, Shaugh church, near Plymouth, which *had not* a conductor, was some few years since struck by lightning, and both the tower and church much shattered. The protection which the Plymouth church received, appears to have made so much impression on the public mind here, that the conductor has been again applied to the church; besides that, many persons in the neighbourhood have furnished their houses with lightning rods.

In a following Number, I hope to be allowed to offer a few remarks on the application of lightning conductors as a defence against atmospheric electricity, when I shall further show the insufficiency of Lieut. Green's statements.

I remain, Sir,
Your obedient Servant,
WILLIAM SNOW HARRIS.

Union Street, Plymouth,
Sept. 5, 1827.

* This ship was at that time under the care of Lieut. Allen, R.N., and I beg leave to refer to him, as having been on board when the ship was struck.

† It may not be amiss to state, that this church has for many years been furnished with a conductor, which consisted of brass wire. It passed down inside the steeple, and from thence out through one of the windows in the tower below; its termination being in the shed above named, and not in the moist ground. From the length of time this conductor had been exposed to the action of the atmosphere, it had assumed a black appearance, and had been very loose at the points where the lengths of wire were united; moreover, the conductor was of very small dimensions. That such a conductor should be disjointed by the passage of a powerful electrical discharge, and that the ground should be torn up by the passage of the electric matter from the foot of the conductor, is not at all singular.

METHOD FOR FINDING THE HEIGHT OF A BALLOON BY SOUND.

BY MR. WM. SHIRES, MATHEMATICAL TUTOR.

Let a detonating ball be made as large as a goose egg; and while your watch is at your ear, count its beats from the time of the ball being let fall from the side of the balloon, until the sound of its bursting returns to the balloon; which time call m, seconds of time. Let $T =$ seconds of time of falling, and $t =$ time of the sound returning from the ground to the balloon: then, since sound flies at the rate of 1142 feet per second of time; and that, at a little distance from the earth, a body falls 16 feet in the first second of time; whence, if $h =$ height sought, then, from the nature of gravity, $16\,T^2 = h$; from sound, $1142\,t = h$; and from the statement of the question, $T + t = m$; from which,

$$h = \frac{571}{16}\left(\sqrt{(571+32m)} - 23,9\right)^2$$

Note.—If your watch beat half seconds, half the number of beats must be substituted for m, in the last equation; that is, the time must be brought to seconds before it can be substituted for m; and in order to make this experiment correct, the ball must be filled with sand, to make it overcome the resistance of the atmosphere.

W. S.

ON THE ARITHMETIC OF IMAGINARY OR IMPOSSIBLE QUANTITIES.

Sir,—After the simple and very satisfactory demonstrations given in No. 210, by Mr. William Russell, on the involution of imaginary quantities, I fully expected that nothing more would have been advanced on the subject. But it appears that Mr. Henry Ottley* is a veteran of too sound courage to allow himself to be placed *hors de combat* by such soft metal as the weapon of demonstration. He reminds me of Goldsmith's country schoolmaster, who, "*When he was vanquished, could argue still.*" For, in No. 212, he has again boldly returned to the charge, and given us another elegant specimen of what Mr. William Russell humorously phrases "an Irish demonstration;" which he (Mr. W. R.) defines to be "*no demonstration at all.*" But really, to be serious, I must beg leave to state, that there has never been a difference of opinion on this subject among *algebraists;* and that Mr. Felix Ford has made a concession to Mr. Henry Ottley, which he was not warranted in doing. In No. 208, page 80, Mr. Felix Ford says, "If the celebrated mathematicians, Emerson and Euler, differed in their opinions regarding the true product of $\sqrt{(-a)}$ and $\sqrt{(-b)}$; the former asserting it to be $\sqrt{(-ab)}$,* and the latter $\sqrt{(ab)}$; what may be said, then, of the opinion of so humble an individual as Felix Ford?" &c.

Now, Mr. Felix Ford, in your first communication on this subject (No. 196), you noticed two errors in "Euler's Algebra," Article 148, page 63, Vol. I. of the English translation. But had you adverted to the two preceding Articles, and had you carefully examined the whole work, or at least that part of it which treats on the subject of Imaginary Quantities, you would have been convinced, beyond a possibility of doubt, that the errors which you have pointed out are merely accidental, and not errors in judgment. This will be apparent from his (Euler's) method of proving that the three roots of the equation, $x^3 = 8$, are 2, $-1+\sqrt{-3}$, and $-1-\sqrt{-3}$. (See page 360, Vol. I. second edition).

Euler's proof is as follows:—

That $x = -1+\sqrt{-3}$, and $x = -1-\sqrt{-3}$, will be evident, by actually cubing these expressions.

---

* Printed "Oxley" in our last by mistake.

* This should have been $-\sqrt{(ab)}$.

$$
\begin{array}{r}
-1+\sqrt{-3} \\
-1+\sqrt{-3} \\
\hline
1-\sqrt{-3} \\
-\sqrt{-3}-3 \\
\hline
-2-2\sqrt{-3} \text{ square} \\
-1+\sqrt{-3} \\
\hline
2+2\sqrt{-3} \\
-2\sqrt{-3}+6 \\
\hline
8 \text{ cube.}
\end{array}
\qquad
\begin{array}{r}
-1-\sqrt{-3} \\
-1-\sqrt{-3} \\
\hline
1+\sqrt{-3} \\
+\sqrt{-3}-3 \\
\hline
-2+2\sqrt{-3} \text{ square} \\
-1-\sqrt{-3} \\
\hline
2-2\sqrt{-3} \\
+2\sqrt{-3}+6 \\
\hline
8 \text{ cube.}
\end{array}
$$

Now, Mr. Editor, if the above proof, copied from Euler, will not convince Mr. Henry Ottley that he is wrong in his application of the signs of imaginary quantities, he deserves to remain for ever in total darkness.

I am, Sir,
Your's, with respect,
G. S.

FALLING BODIES.

Mr. Editor,—I feel much obliged to T. C. E. for his polite answer to my query of the 30th of June last. The experimental instrument he recommends, I had in my possession before. I believe it to be perfectly correct that the authors of the various publications respecting falling bodies, intend their calculations to apply to such bodies when *in vacuo* only, though they do not so express it. But then, Sir, how is it, that these same professors inform us, that we may ascertain the depth of a pit, or the height of a cliff, by letting any heavy body fall down to its bottom, noticing the time it occupies whilst falling? Surely it is not their intention that the pit should be first voided of air, nor that the body should fall from on high *in vacuo*? Why do not they explain this better? and why leave things, which ought to be clearly elucidated to the young student, unexplained?

The Rev. J. Joyce, in his "Scientific Dialogues," Vol. I, page 64, states, that "with the assistance of a stop-watch, he could tell the height of any place, by observing the number of seconds that a marble, or any other heavy body, would take in falling from that height."

Let T. C. E. permit me to ask, whether he does not think with me, that the Rev. J. Joyce is very wrong in this assertion; especially as he makes no difference between a marble or any other heavy body; the air exercising (as is well known) a very different influence upon different bodies.

I beg you, Mr. Editor, to pardon the length of my epistle, occupying so much of the valuable space of your pages, and to accept as my apology the assurance that, *pro bono publico*, I aim at more than what the apparent insignificancy of the question, contained in my last, would imply; viz. to make the demonstrations of scientific hypotheses set forth by the several professors, clearer to the comprehension of the young student, who frequently finds himself perplexed by the want of more copious explanations.

If my remarks are ill-founded, I shall feel highly obliged to T. C. E., or any other gentleman, to set me right. But if, on the contrary, my observations should be found to rest on truth, then I shall feel myself emboldened to advert, with your permission, to other points which I conceive to be much more important, and which call for eclaircissements; especially touching mechanics, in the service of which I am an old and active veteran, protector of a powerful steam engine, four large boilers, two towering chimneys, many thousand wheels, seven lathes, a multitude of vices, with a great many &c.s.

This, Mr. Editor, is a large family; and I know that, as a friend and patron to such a congregation, you will with pleasure hear from me, that I spend my days in the midst of them with inward satisfaction.

I am, Sir,
Your most obedient Servant,
ABEL DABBLER.

Prescot, Sept. 4, 1827.

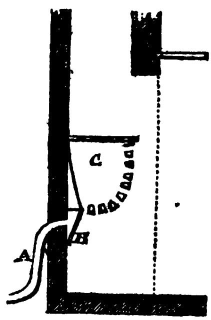
SMOKY CHIMNEYS.

July 30*th*, 1827.

Sir,—Allow me to add another cause and cure of smoky chimneys, to the list already furnished by your able correspondent, John Smith.

It is pretty well known, that in rooms in which a fire is burning, a considerable quantity of air is consumed, to replace which the external air is continually rushing in at every crack and crevice, causing unpleasant draughts; or if this is prevented, by stopping up the holes at the doors, windows, &c., the air will descend down the chimney, bringing with it the smoke, and can only be prevented from doing so, by opening a door or window; leaving the occupant the choice of two evils, *smoke* or *draught*.

To remove this inconvenience, let a tube be laid from the fire-place to the outside of the house, as I have endeavoured to show in the accompanying sketch.



A is the tube, entering the wall at the back of the under part of the grate C, and communicating at the other end with the external air. B is a piece of sheet iron to prevent the cold air from entering the room, without passing through the fire. By this arrangement, a constant supply of fresh air is furnished to the fire; which expanding, will partly enter the room, communicating an agreeable warmth, while a constantly ascending column in the chimney will be insured.

I remain,
Your's respectfully,
W. BADDELEY, JUN.

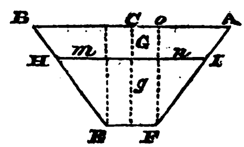
10, *George-yard,*
Lombard-street.

FOURTH VIEW OF THE RESERVOIR CASE.

(See p. 311, *Vol. VII.)*

Sir,—Since your able correspondent, Mr. Mackinnon, has furnished so neat a solution to my "Third View of the Reservoir Case," I cannot be so uncourteous as not to bestow due attention on the view *he* has proposed; which, when answered correctly, will, I think, set that matter entirely at rest; and, together with the results that have already been forwarded to you by different correspondents, will furnish the labourers with the necessary information, that each party may have what is just.

By referring to the solutions of the First Case, already before your readers, (No. 165, Dec. 1826,) it will be seen that the second party would have to pump out 13·028 feet of the depth; consequently the depth the first party would pump out is 20—13·028=6·972 feet. It is evident that the bottom, H I, of



the upper half is equal to 2 Hm+ m n (E F); but E o : A o : : E m : H m, or 20 : 16 : : 13·028 : H m= 10·4224 . ·. H I=10·4224 × 2 + 8= 28·8448. Mr. M. in his answer to the Third Case, (No. 195,) finds the centre of gravity, g, of the whole

body of water to be 7·7777 feet from the surface; and the number representing the power exerted to pump out the whole of the water to be 3733·296. In the same manner, the centre of gravity of the first part may be found; or $C\,G = \frac{A\,B + 2\,H\,I}{A\,B + H\,I} \times \frac{C\,D}{3} = \frac{40 + 57{\cdot}6896}{40 + 28{\cdot}8448} \times \frac{6{\cdot}972}{3} =$ 3·2975236; then the area A B H I, or $240 \times 3{\cdot}2975236 = 791{\cdot}405664 =$ number representing the power exerted by the first party to draw out half of the quantity; but the power required to draw out the whole is as 3733·296, and the money for drawing the whole is £66. 19*s*. 3¼*d*. +, (as shown in No. 165, Dec. 1826;) therefore 3733·296 : 791·405664 :: £66. 19*s*. 3¼*d*. + : £14. 3*s*. 10¾*d*.—the sum the first party ought to receive, provided they drew out half the *quantity* only.

Perhaps, if I collect into one view the conditions on which they should proceed in each case, it will conclude the question more distinctly. Case 1. To draw half the quantity, the first party must pump out 6·972 feet of the depth; but that is so far from performing half the *labour*, that, by Case 4, their share of £66. 19*s*. 3¼*d*. (the sum for drawing the whole) is only £14. 3s. 10¾*d*. It is probable they will now say, "since employment is scarce, (as unfortunately it is,) we will perform half of the labour, that we may receive half of the pay;" they must then, by Case 3, pump out 11·632 feet of the depth, and they will be justly entitled to half of the whole sum, or £33. 9*s*. 7½*d*.

J. E. BARRAT.

ASTRONOMICAL QUERY.

Sir,—I have been a great deal puzzled with respect to the following circumstances;—In converting time into arcs, it is usual to allow 15° for *one* hour in time, whether that time be given in *mean solar*, or *sidereal time*. Now this does not appear to me to be correct: for instance, suppose an emersion of the first satellite of Jupiter takes place at Greenwich on March 9, 1826, at 6h. 34m. 15s., and suppose that, under a second meridian, this emersion takes place at 14h. 6m. 25s., both in *mean solar time*; then, in this case, the longitude of the second meridian from Greenwich will be 7h. 32m. 10s., which, at 15° per hour, will be 113° 2′ 30″ E. in arc. But let us suppose the observations at the two places were made in *sidereal time*, then the emersion at Greenwich will be at 6h. 35m. 19·77s.; and at the second meridian at 14h. 8m. 44·04s., making the difference in time between the two meridians = 7h. 33m. 24·27s.; which, at the rate of 15° per hour, will give the longitude in arc = 113° 21′ 4″ E., which is greater than the above by 18′ 34″. Now, which of these two is to be considered the *true* longitude from Greenwich?

Again, in the tables of latitude and longitude of places from Greenwich, the longitudes are usually given in time, as well as degrees, minutes, and seconds; now in what measure of time are these longitudes expressed in? For this ought to be known, before we apply the time at Greenwich to the longitude in the tables, when we wish to know the time under any other meridian.

I remain, Sir,
Your Constant Reader,
RUS ASTRO.

HYDRAULICS.

Mr. J. M. Cooper, of Gintdhall (Vermont), is stated in the American papers to have invented a new hydraulic machine of extraordinary powers. It is described as consisting of a cylinder eight inches long, and as many in diameter, with a winch, the two extremities of which are attached to a pivot. The strength of four men is sufficient to make it throw constantly a stream of water, three quarters of an inch in thickness, 120 feet distance in a straight line, and more than 90 feet perpendicular. The inventor has given it the name of the Rotatory Piston.

METHOD OF PRINTING CLOTH.

Sir,—The following method may be employed for printing cloth of a black colour. Take *Malacca nuts;* boil them in water, in close earthen vessels, with the *leaves of the tree;* during the time of boiling, a whitish substance, formed from the mucilage and oil of the nuts, rises to the surface, which must be taken off and preserved. The cloth intended to be black, must be printed with this *scum*, and then dyed; after which it must be passed through *lime water*, which changes the printed figures to a full and permanent black.

I am, Sir,
Your's, &c.
JAMES COX.

Nursery Place, Hackney,
Aug. 26, 1827.

METHOD OF DESTROYING MOLES.

Collect earth-worms, kill them and mix them up with the powder of *nux vomica*. After the mixture has remained in a heap twenty-four hours, take the worms, and place one or two here and there in the routes and holes of the moles, to whom it will speedily prove destructive.

CURE FOR MOULDINESS.

Mouldiness in the timber of a house may be prevented by washing it over with a weak solution of muriate of mercury. The repair of a church, at Potsdam, the timber of which was quite new, and was covered with mould, is said, in the Bulletin Universelle, to have given rise to the discovery.

ARTIFICIAL BLOOM.

A fine bloom is given by fruit-dealers to cucumbers, grapes, peaches, plums, and other fruits, after the natural colour has faded, by powdering them with magnesia, pounded as fine as possible. It may, at first sight, appear surprising that a *white* powder should give an equal bloom to fruits of different colours; but the colour resides in the skin, and the magnesia has merely the effect of bringing that colour out. —*Abridged from the Gard. Mag.*

On mentioning the above to a friend, he observed, that it was owing, he presumed, to a similar cause, that he had seen the colours of a carpet, on which some calcined magnesia had been accidentally scattered, completely revived.—*Edit. Mech. Mag.*

NOTICES TO CORRESPONDENTS.

N. N. may, we believe, obtain the article he wants from Mr. Joyce, Chemist, Old Compton-street, Soho.

"A Neighbour" is requested to authenticate the facts of which he speaks in his "Remarks on the Renovation of Windsor Castle."

We shall return in time enough to the subject of the Thames Tunnel; but agree, in the mean while, with "A Long-shoreman," that "the puffing paragraphs about it which appear daily in the newspapers do no credit to any of the parties concerned."

"Fabricius" has omitted to send the model to which his description refers. A drawing of it will do.

We did not say, as "Verax" alleges, that the Society for the Diffusion of Useful Knowledge "is actuated by party purposes." We merely hinted, that, consisting as it does chiefly of party men, it is scarcely to be expected that, when party questions come to be discussed in its Treatises, a rigorous degree of impartiality will be exercised.

Communications received from W. Webb—W. D.—H. O.—*—J. W.—E. O. T.—F. G.—Edward Knox.

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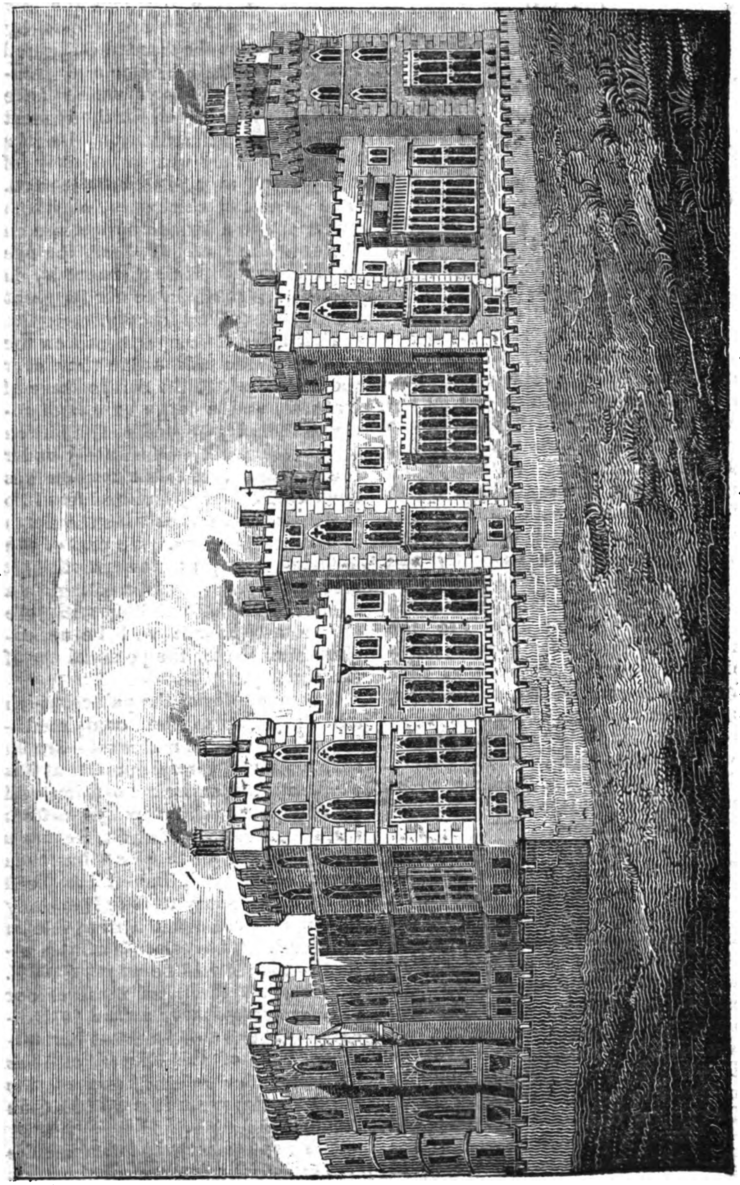
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 215.] SATURDAY, OCTOBER 6, 1827. [Price 3d.

FRONT VIEW OF WINDSOR CASTLE.



ON THE IMPROVEMENTS OF WINDSOR CASTLE.

(From the Communications, chiefly, of Mr. C. Davy.)

NO. III.

South and East Sides.

Having in our two former notices described the improvements which have taken place in the two grand entrances—King George the Fourth's Gateway, and the Porch to St. George's Hall—we now present our readers with a view of the whole of the south and east sides, as seen from the south-east angle. The general effect of the building, in this point of view, must, we think, be allowed by every one to be exceedingly noble and impressive. Contrasted with the metropolitan palace erected on the site of Buckingham-house, it makes one marvel that the two buildings should belong to the same era; for though Windsor Castle be but a restoration of an ancient style, the same taste which dictated that restoration might have been expected to frown extinction on such an unsightly and incongruous mass as has been reared in St. James's Park.

First on the left hand are the York and Lancaster towers, exhibited in our last drawing as seen from the interior of the quadrangle, and here as viewed from the outside; next, the King's tower; then come, towards the right, the Chester, Clarence, and Black Prince towers; between the last two of which is the grand dining room.

Immediately abutting the Black Prince's tower, but round the north-east angle, is a new octagonal tower, which forms altogether one of the most imposing features of the palace. It is the highest of all the towers, and higher than any other part of the building; rising 120 feet above the level of the terrace. It was originally intended to call it the *Brunswick* tower, that it might be in historical keeping with the *York*, *Lancaster*, and other towers; but his Majesty, in compliment to the architect to whose talents the renovation of the Castle owes so much, has been pleased to name it *the Wyattville tower*,—a change which will probably be generally considered to do more credit to his generosity than his judgment.

To those who recollect the low and tasteless French windows by which Charles the Second disfigured this palace, the elegance and grandeur of the windows which have been now substituted for them must be particularly striking. On the south side they are principally of the pointed arch, or square headed. The beautiful oriel ones, of which we spoke in a former notice, are on the east side; and of these, the one in the grand dining room is, in particular, remarkable for its great size and luxuriant tracery.

From the state apartments on the east side, there is a fine view over the little Park to the rural village of Datchet, and a large extent of romantic country beyond it. In addition to the old walk immediately under the windows, a noble bastion has been carried many hundred feet into the Park, and unites with the north and south terraces. On part of the included area, at the north-east corner, an orangery is erecting, in a similar style of building with the Castle, and near it will be an enclosed garden for the personal use of his Majesty.

The two sides of the palace which still remain to be completed—namely, the north and west—are in such a state of forwardness, that it is supposed the entire renovation will be completed within two years from this time. The roof of St. George's Hall (on the north side) has been found so decayed, that it has been deemed necessary to take it entirely down, and construct a new one in its stead. The expense of this alteration alone will be about 20,000*l.* St. George's Hall, as most of our readers are probably aware, is dedicated to the use of the most honourable Order of the Garter, and has long been considered one of the finest in Europe; it is no less than 108 feet in length.

Our next notice will introduce the reader into the *interior* of the parts

already finished; and though he must not expect to see *Gothic* style so rigidly exemplified here as in the outward embellishments, he will not be sorry to find small and ill-arranged rooms, such as were common to all Gothic castles, displaced by apartments of regal amplitude and magnificence, and yet in perfect harmony with the exterior character of the building.

MALARIA, AND ITS RAVAGES.

In our account of the New Palace, St. James's Park (No. 205), we recommended to the particular notice of our readers, an Essay by Dr. M'Culloch *on Malaria*, in which he shows that the fevers so common in this country from June to November, and which are popularly designated by the general term of *typhus*, are mostly the effects of the malaria generated in warm weather by lakes, ponds, meadows, marshes, ditches, and generally all standing and sluggish waters, and all low and wet grounds. We animadverted at the same time on the want of moral courage, which had led Dr. M. to "dislike naming the places" most subject to this cruel pestilence; and took it for granted, that had he but chosen to speak out, he would, as regards the metropolis, have at once denounced the whole of the ponds in St. James's Park, the Green Park, Hyde Park, Kensington Gardens, and the Regent's Park, as utterly injurious to health, however pleasing to the sight. The omissions of Dr. M. have been viewed in the same light by a writer in the last No. of the Quarterly Journal of Science; who, in the form of a Review of Dr. M.'s Essay, has amply supplied that sort of illustration, in which it is deficient.

"It is notorious," he says, "that in the last autumn, the remittent fevers in various parts of the country amounted to a species of pestilence, such as has been scarcely known in England from this cause (malaria), or we might almost, indeed, say from any other disease, since the days of Sydenham. Wherever ague had *ever existed*, or even been supposed *possible*, in those places was this fever found; so that in all the well known tracts in Lincolnshire, Norfolk, Suffolk, Kent, Essex, Sussex, Hampshire, and so forth, there was scarcely a house without one or more inhabitants under fever; while the event, as might be expected, was a considerable mortality. So extensive was its range, that even Hastings did not escape; and every other town on the sea-coast was so much infested by it, that persons who resorted to them for bathing suffered in considerable numbers. To come nearer home, the same fevers were extremely abundant in various parts of the outskirts of London, as also in the villages and towns connected with it, within a range of from six to ten miles." The writer then particularizes the various streets from Buckingham-gate to Chelsea, Lambeth, Rotherhithe, Deptford, Ratcliffe-highway, Greenwich, Woolwich, Plumstead, Dulwich, Lewisham, Fulham, Ealing, Chertsey, and even Richmond; "But whatever," he proceeds, "was the pestilence of last year, it promises *to be much greater in the present one*. This is easily judged of, from the manner the season has set in; but still more decidedly, from the extraordinary prevalence of ague in the spring; since that which is intermittent fever then, will be remittent in the autumn, or rather, as Dr. M'Culloch has justly remarked, there will scarcely be a definite season of vernal intermittent, but the remittent will commence immediately, increasing in extent and severity as the summer advances, and promising to become, in the autumn, *the greatest season of disease that England has known for this century*." In evidence of this, the writer mentions two or three facts, which he conceives are as decisive as a thousand would be. Ague is at this moment extremely abundant, where it was formerly scarcely known: for example, at Fulham, Ealing, Greenwich, and in the heart of London itself. Where single cases too used to occur, there are now hundreds. In the Military

Hospital, at Woolwich, there were in the spring three hundred patients with this disease; while, in former times, an ague was scarcely known once in five or six years.

The reader may wonder how it happens that malaria should become all at once, as it were, so extensively prevalent in England. The explanations given on this head are equally curious and satisfactory. "The last few years have been distinguished for an uncommon prevalence of *east winds*, and to such a degree indeed, that we can find no meteorological records at all to be compared with the history of these years. And while the history of intermittent and remittent diseases, in London, at least, from the time of Moreton and Sydenham downwards, shows that all periods of such diseases have been periods of east winds; it is not difficult to see how it acts as to both classes of marsh fever. To London, in particular, it is the best conductor, propelling the malaria from all the marsh lands to the eastward. To the east coast, if Dr. M.'s theory is valid, it brings the malaria from Holland; and moreover, as it forms our hottest summers, it causes our climate to approximate more to the southern ones, and thus enables our own lands to produce a greater quantity of malaria than in ordinary summers."

It is always to be kept in mind that an elevated temperature is necessary to the production of this poison. What that precise degree is, has not been ascertained; but we may mention, for the comfort of our friends beyond the Tweed, that Dr. M'Culloch pronounces the greater part of Scotland to be incapable of generating malaria.

The principal means recommended by Dr. M. for staying the progress of this pestilence, are, 1. The planting of trees to intercept winds likely to be charged with malaria; after the example of the Romans, who compelled the shores of Latium to be planted to check the current from the Pontine marshes; 2. Fire and smoke,—an experiment which was tried on a very large scale by Napoleon before Mantua, and on a smaller one in Africa, having been attended with perfect success; 3. The use of a full or animal diet; 4. Wine and spirits, especially before going abroad at night, in insalubrious situations; 5. Narcotics, — whence the wide use of tobacco, of which the salutary effects appear to be most amply established; and, 6. draining and embanking, and the utter extinction of all such useless ponds as those in the western part of our metropolis.

For the cure of ague, when caught in spite of every precaution, the several prescriptions given in our 7th vol. pp. 201, 220, 240, 336, 345, and 411, may be advantageously consulted.

Some very extraordinary facts are mentioned by Dr. M. in illustration of the contracting influence of malaria on the duration of life in the different countries which are subject to it. In England, he thinks, the average duration of life may be taken at 50; while in Holland it is but 25, showing that the half of human life is at once cut off by this destructive agent. In some parts of France (occupied by ponds and farmed for an inland fishery), it becomes as low as 22 and 20; and Condorcet has even calculated it to be as low as 18! Few here attain the age of 50, and 40 forms the general limit of extreme and rare old age! The females become old immediately after 17; and have, even at 20, the aspect of old women!!!

ON LIGHTNING CONDUCTORS, BY WM. SNOW HARRIS, ESQ.

Continued from p. 171.)

Sir,—In this communication I will endeavour to lay before your readers the leading principles on which lightning conductors have been employed as a defence against the dreadful effects of atmospheric electricity; the insufficiency of the arguments urged against that fine invention (No. 204, page 13), as well as the inaccuracy of the statements, I will then make further evident.

The application of lightning con-

ductors, whether on ship-board or on shore, is founded on the following demonstrated facts; viz.—

The cause of lightning is identical with that of common electricity, and all the known laws which regulate the operations of the one also direct those of the other.

The following are amongst the principal of the laws of electrical phenomena:—

1. Whenever an electrical discharge occurs, there are two primary points of action.
2. Some substances conduct or transmit an electrical discharge with more facility than others; and those substances which transmit it with the least facility, are the most damaged by it.
3. An electrical discharge always passes in the shortest possible course between the primary points of action in which it finds the best conductors.

These facts are very well illustrated in every observed case of damage by lightning,—the ill consequences being most apparent where the *best conductors are wanting*, and immediately in the track of the explosion, which thus determines for itself a line of communication between the points of action, viz. the earth and the clouds.

Now, it must be remembered that most substances have the power of transmitting electrical discharges, although many are considered as imperfect in this power compared with others: thus water, hemp, stones, &c. are, to a great extent, conductors of electricity; although imperfect ones, when compared with the metals, *but still they are conductors:* this must be very evident to most persons, since a moist atmosphere is fatal to many electrical experiments, and sparks cannot be obtained from the prime conductor of an ordinary electrical machine when it is brought into contact with the wall of a house, either immediately, or by means of a rope or a piece of unbaked wood.

When, therefore, we erect any elevation on the earth's surface, we immediately set up a conductor, on which the electricity of the atmosphere will necessarily fall, and no human effort can prevent it; thus we find the luminous phenomena of natural electricity, observed on the masts of ships, on the tops of steeples, and even on the elevated portions of men and quadrupeds, recorded from the earliest periods.

Whilst the conducting power of these different bodies is equivalent to the action which thus assails them, THEY ARE SAFE; when it is not, THEN DAMAGE ENSUES: it seems reasonable, therefore, to give them all the conducting power possible, by such artificial means as are within our reach. Now, metallic substances have this conducting property to a very considerable extent; and thus, by providing continuous metallic communications between the highest point of artificial elevation and the earth or sea, we, in a great measure, facilitate the operation of nature, by dissipating the electrical accumulation going on in the atmosphere; or, if such accumulation be so far advanced as to strike on the conductor, then there is the least possible resistance to the powerful agency in operation, and consequently much damage must be avoided.*

It will be here proper to remark, that the electric explosion thus parried is quite independent of the elevated body, or of any metallic apparatus affixed to it; and, being a natural operation of vast extent between the clouds and the earth, it will necessarily proceed, whether such body be present or not, or whether equipped with lightning-rods or not. It is necessary to bear this in mind, because many persons have

* This was most clearly shown a short time since in the protection which the packet ship New York received from a lightning conductor,—the ship having been struck by lightning twice in the voyage—first, *without a conductor;* secondly, *with a conductor.* In the first instance, the ship was in danger of *being sunk,* beside *other damage:* in the second instance, the lightning passed *down the conductor, and shattered it, but the ship escaped.*—(See Liverpool Commercial Chronicle, in May, 1827.)

supposed that an exclusive action is set up between the metallic apparatus affixed to a building, or ship, and the clouds; and hence has arisen the erroneous idea that such apparatus "invites the lightning," and endangers the ship or building, which otherwise would be perfectly safe.

This opinion is, however, contrary to all fair reasoning; since we find a multiplicity of cases recorded, in which artificial elevations have been assailed by lightning, where such metallic apparatus has *not been present*;* and in nature, more especially, we find that trees of all altitudes, rocks, and animals, are, even in an open country, equally the victims of its fury—instances which are quite conclusive as to the fallacy of the notion.

If it should appear desirable to add any thing further on this point, I would adduce the argument founded on experience of the very application: for if, as asserted, lightning-rods are calculated to draw down on mankind the destruction they are intended to obviate, by "inviting" an electrical explosion, how is it that almost every powder-magazine in Europe, furnished with pointed conductors, is not exploded? Accidents of this kind have happened before the invention of such conductors; as at Brescia, in Italy, mention of which is made in the Transactions of the Royal Society for the year 1773: whereas, since powder-magazines have been generally protected by lightning-rods, no such instance is on record. The same may be said of the more ordinary damage done to buildings and ships, which occurs in almost every instance where *lightning conductors are not present*, the exceptions being so very few, compared with the number of cases, as not to have, in this point of view, any assignable value; beside which, as we shall presently see, these very exceptions are frequently of so decided a nature, that they avail nothing as arguments even against lightning conductors as a *negative good*, much less do they show them to be a *positive evil*.

The notion that we invite destruction, by employing lightning conductors, is therefore a false one, and is contradicted by the most commonplace experience; to say nothing of the numerous instances in which buildings and ships have been saved from such destruction by their judicious application: it is further an unsound argument, fitted only for the fears, not for the understandings, of mankind.

The great desiderata in applying a lightning conductor, and which cannot be too strongly impressed on the public mind, are as follow:—

1. To let it project freely into the atmosphere.
2. To have it *perfectly continuous*, and of as large dimensions as is convenient. The conductor should likewise be of *copper;* that metal having a great superiority over every other metallic substance, except silver, in its power of resisting fusion by an electrical explosion.
3. To let it have a perfect contact with the moist earth, or with a collection of water, if applied to a building; or otherwise with the sea, if applied to a ship, which is, in most cases, very effectually done, by connecting the conducter with the copper sheathing on the ship's bottom.

The necessity of the last is very evident; for unless the electric explosion pass off freely from the foot of the conducting rod, its action is impeded; and it is in that case more or less inefficient. The explosion, in consequence, falls on other points of the building, as in the case of Heckingham poor-house, related in the Transactions of the Royal Society for the year 1782;—a case, as I shall soon show, much mistaken and misrepresented in the letter on lightning conductors before alluded to.

A fine illustration of the power of a lightning conductor, is to be found in the experiments of M. de Romas, who discharged much of the force of a thunder-cloud over a small wire, wove in the string of a kite, which

* See Account of Damage by Lightning.—*Transactions of the Royal Society for the year* 1774, *page* 162, *vol.* 69.

be made sensible by insulating it—when "streams of fire, an inch thick and ten feet long," were observed to dart from the lower extremity of the kite line into the ground.*

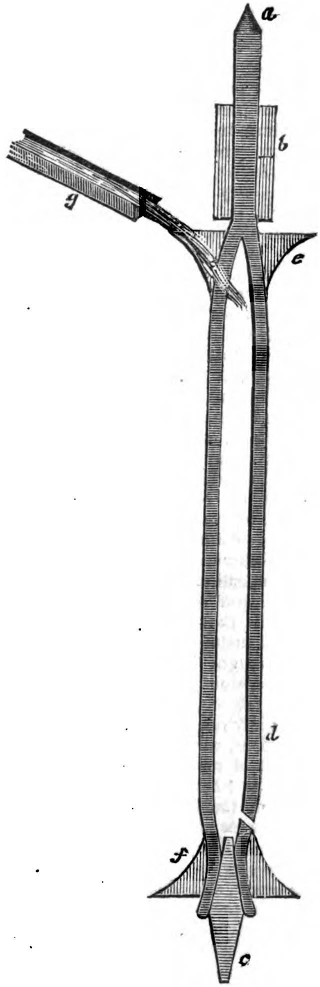
Andrew Crowe, Esq. of Broomfields, near Taunton, a gentleman of considerable scientific attainments, has employed a very extensive atmospheric apparatus, from which similar effects have been witnessed. During the passage of a thunder-cloud, a full dense stream of sparks passes to the receiving ball, which, at every flash of lightning, is changed into an explosive stream, accompanied by a peculiar noise; and it has been well observed by Mr. Singer, in his excellent work on Electricity, "that during this display of electric power, so awful to an ordinary observer, the electrician sits quietly in front of the apparatus, conducts the lightning in any required direction, and employs it to fuse wires, decompose fluids, or fire inflammable substances; and when the effects are too powerful to attend to such experiments securely, he connects the insulated wire with the ground, and transmits the accumulated electricity with silence and in safety."

It was by means of a contrivance similar to the insulated part of this apparatus, by which the celebrated Russian philosopher, mentioned in Lieut. Green's communication, lost his life; in his case, the *lightning conductor* for transmitting the accumulated *electricity was* WANTING. Lieut. Green's statement of this unhappy circumstance, is not only an instance of misrepresentation, but of great misapprehension concerning the nature and effect of a lightning conductor.†

(To be continued.)

AMERICAN MILL SPINDLE.

The following account of an improved spindle for flour and corn mills, is extracted from a communication to the American Mechanics' Magazine, by a Correspondent.



The drawing prefixed is a vertical section, by which it will be seen that the outline is similar to mill-spindles in common use; but the body is larger, being usually of cast iron, about three and a half inches in diameter, and either round or octagonal, &c.: it is hollow, like a pipe, up to the collar; by which distribution of metal, greater strength and stiffness are acquired, than if solid, and of equal weight. At the bottom, the bore is tapered upward several inches, which forms a socket for inserting a toe, which, if of wrought

* Mémoires des Savans Etrangers.

† An account of M. ——'s electrical gnomon, with which we have been favoured by a correspondent, shall be given in an early Number.—Edit.

iron, should be steeled at the point; a wrought and steeled cockhead is also inserted at the top, in a square socket; or it may be tapped and screwed in. Both these points should be secured, by a screw or pin, at the side, and a band should be driven on the lower end of the casting, to prevent splitting.

At the collar, a small shoulder is formed, leaving the neck rather smaller than the body of the spindle, but solid, or nearly so, in order to maintain the requisite strength. The collar is made of any suitable metal, either cast or wrought, (I prefer the composition used in machinery for inks,) with the bore large enough to go on the neck quite loose, and is then secured by filling the interstice with lead, or any soft metal; it may also be pinned.

The advantages of this spindle, I conceive to consist in its greater strength and stiffness, as before mentioned, and that the wearing parts, while made of the most durable metals, are more readily repaired or replaced. The cost of making, or repairing, will be less than that of a solid wrought iron spindle of equal workmanship.

An objection common to this, with all cast iron spindles, will probably be made, viz. that a cast shaft, or spindle, although sustaining equal stress of torsion with wrought iron of the same shape and dimensions, will yet be liable, from a sudden shock, to break and be useless; while the wrought iron, in the same circumstances, would but twist, and so as to admit of repairing. To obviate this objection, I have introduced a cast-iron driver, of the usual form, and of such thickness as to bear rather less stress than the spindle, that, in case of accident, (which very rarely occurs,) the driver shall break, and thus operate as a safety-guard to preserve the spindle, and the other machinery.

I am informed, that, in Great Britain, it has been been quite a desideratum, to prevent or reduce the expansion of spindles, which occurs from heat generated by friction.

I do not know that this object has been attained, and would suggest, that it may probably be effected in the following manner:—

Let a funnel-shaped rim be attached to the spindle, just below the collar, into which water may be conducted by a spout, and thence introduced, by a hole or holes made in the spindle, to its interior: the centrifugal force will probably spread the water over the interior surface; and the exterior surface may also be kept wet, if needful, by allowing water to pass between the rim and the spindle. The water may be thrown off the spindle, by holes near the toe, conducting it over an inverted rim fixed there. The effect of a constant stream of cold water, thus applied, must be to prevent expansion, or to render it nearly insensible.

BELIDOR.

Explanation of letters of reference.

a—the cockhead.

b—the collar.

c—the toe.

d—a square, or cone, to receive a stone-pinion.

e—a funnel-shaped rim, to receive water from the spout *g*.

f—a similar rim, inverted, to throw off the water.

NAVAL ARCHITECTURE.

(REPLY TO NOAH, p. 45.)

Sir,—I regard "Noah" as merely seeking in his own way the knowledge which I seek also in mine, and therefore he may rely upon it that I shall not be angry with him, whatever he may be with me. But I cannot suffer false theory or unfounded assertions to pass current; and therefore, for our common good, I must do what I can to show Noah that he is in error. This I will endeavour to do in his own way, and from his own assumptions. I have taken a piece of deal, one foot long, and four inches wide by two and a half deep. The ballast to immerse it nearly, was one pound and a half; this, divided in three parts, was placed at each side and on the centre of the bottom. A short mast being then placed in the centre of the deck, a line from the top of it was passed over a small pulley, and a weight being hung to it, the angle made by the mast was observed and marked. The ballast was then removed, and placed altogether along the line of the keel, and the whole being placed as before, the angle was not quite half the former one.

On repeating the experiment several times, the result was nearly the same, the variation being confined to the limit between one half and three eighths of the former angle: it may, therefore, be fairly stated at

one half. Lest, however, the difference of form should lead to mistake, I varied the experiment as follows.

I took a section from the middle of the model of a boat. The section was one foot long, eight inches wide, and five and a half deep. I fixed the ballast necessary to immerse the section to its water line, one-third on the keel, and the other two-thirds in equal portions outside the side, so that the lower edge of each plate should coincide with the water line. This I did that the ballast might have the utmost benefit of the *lever* which Noah speaks of. With a weight of four ounces, the angle was then marked, and afterwards with eight ounces; each experiment being repeated several times, and the mean result taken. The whole ballast was then fixed to the keel, and the experiment repeated several times; when it was found that the angle varied between one-half and five-eighths of the former one. This difference between the former and latter experiments was to be expected; because, in the first case, the ballast was relatively higher; while in the latter, that ballast which touched the water, of course acted by a shorter lever. I may observe, however, that, on Noah's principle, the difference will be quite inexplicable, and I must not forget to remark, that in every case, the model, when ballasted on his plan, lost its stability and overset when drawn upon its beam ends; while that which had its ballast below, bore to be drawn over till the deck was perpendicular, and righted itself the moment that the force which held it was diminished.

I think, therefore, that I may recommend the boy who wishes his model to have the greatest stability, to place the ballast in the keel, notwithstanding all that has been said. In another communication with which I must trouble you, I shall examine the hydrostatical question proposed for our consideration by Noah.

I am, Sir,
Your obedient Servant,
PHILO-NAUT.

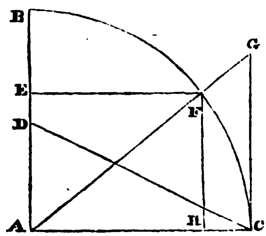
ALGEBRAIC SOLUTION OF THE GEOMETRICAL PROBLEM.

(*Page* 194, *No.* 296.)

Sir,—Previous to the announcement of the solution of the geometrical problem by your French correspondent, (page 111, Vol. VIII.) I had compiled the following algebraical solution, and consequent construction, of the same interesting problem; which (seeing that the one which has already appeared is explained in language not generally understood, and that my construction is somewhat differently, and perhaps more simply effected) may not be unacceptable.

I remain, Sir,
Your humble Servant,
W. DOWLING.

London, Sept. 8, 1827.



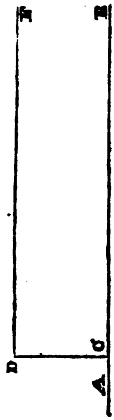
Let $a = AH = EF = CG$, the cosine and tangent of the arc FC; $s = FH$, sine of the same arc; $r =$ the radius AB or AC; then, by similar triangles, $a : s :: r : a$ ∴ $sr = a^2$, and by the prop. of the circle, $r^2 - s^2 = a^2$; comparing these equations $s^2 + rs = r^2$; *completing the square and extracting the root,* $s = \sqrt{r^2 + \frac{r^2}{4}} - \frac{r}{2}$; hence the construction.—Bisect AB in D, and draw DC; make AE = DC — DA, and draw EF perpendicular to AB, cutting BC in F; FC is the arc required.

SUR LES LIGNES PARALLELES.

(*Vide p.* 127, *Vol. VIII.*)

Monsieur,—Tout ce qu'on a écrit sur la théorie des lignes parallèles ne tend qu'à l'embrouiller. Je crois qu'on peut l'éclaircir en peu de mots de la manière suivante:

Sur une ligne droite AB j' élève la perpendiculaire C D, et je suppose que cette droite C D se meut le long de A B, sans cesser de lui être perpendiculaire.



Il est évident que le point D, restant toujours à égale distance de A B, dans ce mouvement, décrira la droite DF, dont tous les points sont également distans de AB; c'est-à-dire, que lui est parallèle.

F.

Translation.

All that has been written on the theory of parallel lines has served only to embarrass the subject. I believe that I can, in a few words, throw some light upon it.

Upon a straight line A B I erect the perpendicular C D, and suppose this line CD to be moved along AB, without ceasing to be perpendicular to it. It is evident that the point D, remaining always at an equal distance from A B, will describe the straight line D F, all the points of which are equally distant from AB; that is to say, it is *parallel to it.*

F.

ON MR. SHIRES' METHOD FOR FINDING THE HEIGHT OF A BALLOON.

Sir,—I beg leave to point out a slight mistake in Mr. Shires' ingenious plan for finding the height of a balloon by sound. He says (No. 214, page 172) that since "at a little distance from the earth a body falls 16 feet in the *first* second of time; whence, if $h =$ the height sought, then, from the nature of gravity, $16\ T^2 = h$:" in this calculation Mr. Shires seems to have entirely forgotten that *no* body *in the open air* will fall through 16 feet in one second, and that the velocities of different bodies vary; hence $16\ T^2$ will not be the height sought. But let $x =$ the height which the detonating ball will fall in the *first* second, and $x\ T^2$ will $= h$.

I should wish, before I conclude, to ask a few questions of Mr. Shires, as I am afraid the plan he proposes will be found objectionable in practice in a few particulars. 1st. Would the sound of the report be heard from the balloon, were it at any considerable height? 2d. Would not the currents of air, which it would meet with in its descent, force the ball considerably out of the perpendicular? And 3d. Would not the consequent calculation be worked on wrong *data?*

I am, Sir,
Your's, &c.
HENRY OTTLEY.

Sept. 29, 1827.

ON THE SOLUTION OF IMAGINARY OR IMPOSSIBLE QUANTITIES.

Sir,—I was truly surprised this day, on examining your Magazine, to find that *another* gentleman (G. S.) had thought proper to enter the field against me. I was undetermined, on reading G. S.'s letter, whether to notice it or not, as I did not see any thing in it that at all affected my argument. I can perceive nothing analogous between the three roots of $x^3 = 8$, and the multiplication of $\sqrt{-a}$ by $\sqrt{-b}$.

Your correspondent pleases himself with calling my demonstration an *Irish* one; now, as Mr. Russell has not yet *defined* an *Irish* demonstration,* I cannot say whether or

* I will not pay Mr. Russell so ill a compliment, as to think, with his defender, G. S., that he *really* intended to say that an "*Irish* demonstration" was "*no demonstration at all;*" and have therefore left him a *chance* of justifying his expression.

not *mine* be one; but be it English, Irish, Scotch, or French, it appears to be one which has *posed* G. S. and Mr. Russell. Until they can prove it to be an *unsound* demonstration, I do not see the use of their writing any more on the subject.

G. S. says, that if he has not convinced me that "I am wrong in my application of the signs of imaginary quantities, I *deserve to remain for ever in total darkness*,"—by which, I conclude, he means that I am not to be enlightened by any further communications from him; but as I am still perfectly confident in my correctness, I am resigned to my fate, and

Remain, Sir,
Your's, &c.
HENRY OTTLEY.

Sept. 29, 1827.

ON FALLING BODIES.

Mr. Editor,—If you are not already tired of this title, and if it is not against the rules prescribed for your publication to admit practical illustration in lieu of theoretical speculations, you may present your readers with the recollection of an actual occurrence very much in point in exemplifying the fact to be as suggested "by Abel Dabbler" (who, notwithstanding he states himself to be the old and active veteran protector of "a multitude of vices," most probably is a valuable and efficient component part of that great steam-engine—the public); viz.—that, provided the action is not *in vacuo*, there *is* an essential difference as to the nature of the bodies falling, in respect of the specific gravities thereof: and this was most curiously proved during the time of the building of Waterloo-bridge. A horse was drawing a low-wheeled car, loaded with a block of granite, when the car tilted, and granite, car, and horse, became "falling bodies" into the river: strange to say, the horse swam ashore, completely divested of every portion of its harness gear! This fact created much astonishment, especially as to how he should have slipped collar, compressed as it was by the hames? But, in this respect, the point of inquiry of Abel Dabbler is exemplified.

Every body knows, that before a collar can be taken off a horse, it must be turned round: the specific gravity, therefore, of the granite and car, being greater than that of the horse, preceded the horse in the precipitation; and, being attached by the chains to the collar, and falling with greater velocity, effected the turn and pull, which released the horse from its precipitous burden, and gave him freedom to reach the shore. But, perhaps, it may to this be objected, that there was not a fair start; to which it may be answered, that as the horse was pulled off the platform *backwards*, and the collar must have passed off forwards, there was, therein, a fair equivalent; and, perhaps, a stronger proof of the greater velocity with which the granite and car fell. But I leave the points to others; observing, however ("*àpropos*"), that I trust no "detonating balls, as large as geese eggs, and filled with sand" as a gravitating medium, as proposed by Mr. Shires, will ever fall from any balloon near me: such a "falling body" would prove as bad as the "falling body" (a flour sack) which, last week, killed an unfortunate man at Whitefriars.

I remain, Mr. Editor,
Your most humble Servant,
W. D.

Oct. 1, 1827.

Sir,—I shall endeavour to remove the doubts expressed by your correspondent, "Abel Dabbler," in your No. for to-day (No. 214); who conceives that the Rev. J. Joyce, in his "Scientific Dialogues," "is very wrong" in asserting, that "with the assistance of a stop watch he could tell the height of any place, by observing the number of seconds that a marble, or any other heavy body, would take in falling from that height." I beg to assure Abel Dabbler, that Mr. Joyce is perfectly correct in this assertion,

though he has not sufficiently explained to his readers the method by which he makes his calculation. For, although no body falls through 16 feet per second in the open air, and though the velocities with which various bodies will fall through the air differ, yet the following principle is *universal*, whether in the open air or in *a vacuum*; "the space through which *any* body will fall in a given number of seconds, is equal to the space fallen through in the *first* second (*whatever* that space be) multiplied by the *square* of the number of seconds given. Thus, if a body falling from the top of a cliff be observed to fall *three* feet in the *first* second, and it reach the ground at the end of the *fourth* second, it is easy to calculate the height of the cliff. Thus, the square of 4 is 16, and $16 \times 3 = 48 =$ the height of the cliff. Also, if a stone falling from the top of a tower 64 feet high, fall 4 feet in the *first* second, it is easily found how many seconds would elapse before the stone would reach the ground. Thus, let x be the number of seconds required, then by the rule $4x^2 = 64$, and $x^2 = 16$, and $x = 4$ = the number of seconds it would occupy in its fall, as required. Hence it appears, that the depth of a pit may be found without voiding it of air," &c.

There are many curious experiments illustrative of this principle, to be performed with "Attwood's machine," which it would occupy too much space and time to describe at present. I may probably recur to them at a future period, and remain,

Sir,

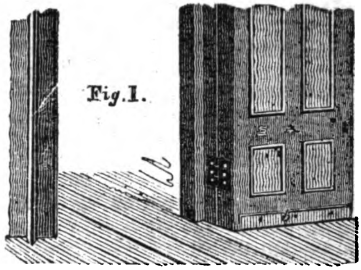
Your's, &c.

HENRY OTTLEY.

Sept. 29, 1827.

MODE OF RENDERING DOORS WIND AND WATER TIGHT.

Sir,—Observing in page 184, vol. VII. of your valuable Magazine, a plan for preventing wind, rain, &c. from getting under street and other doors, I send you another.



3

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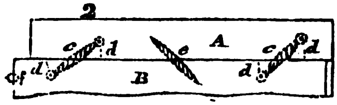


Description.

A, fig. 2, a piece of wainscot, or mahogany, three inches wide and three quarters of an inch thick, rabbeted to receive the slider B, one inch and a half wide, and half an inch thick; *c c*, two pieces of brass or iron let into the middle of the pieces A and B, to move on a pin at each end, at about the same angle as in a parallel ruler. The wood will require to be cut away, as shown by the dotted lines *d d d d*, to allow for the slider coming down; *e*, a spiral spring, a quarter of an inch diameter, also let into the pieces A and B, and secured at each end; *f* a small brass wheel: previous to fixing the slider, it should be scribed down to the floor.

A, fig. 1, the door; *b*, the slider and cover, screwed on to the front of the door; *c*, a small brass plate let into the jamb lining: in shutting the door, the wheel of the slider acting on the brass plate in the jamb, the slider is pressed down to the floor; as soon as the door begins to open, the slider is lifted to its former position by the spring. The bottom of the cover must not be placed lower than the bottom of the door, and the end of the slider to project sufficiently to allow for its closing the cavity between the door and the floor.

If preferred, the door may be rabbeted, and the cover put on flush with the face, as at fig. 3.

I remain, Sir,
Your most obedient Servant,
RICHARD CROSS.

Sept. 8, 1827.

FIRE EXTINGUISHING MACHINERY.

Sir,—Nothing can be more gratifying to my feelings, than the manner in which my communications on this subject have been noticed by "A PEDESTRIAN," and the valuable information they have elicited from him: but as there are a few points on which he has misunderstood me, I must request the insertion of the following explanation to his last letter. (See page 142.)

First, With regard to the plan of Mr. Buston, I published it as "*a practical method of obtaining water, when under ordinary circumstances there is no prospect of such a supply.*" (See page 31.) I also said, "*The plug having been opened, and the water not rising in it, or rising so scantily as not to keep the engine at work;*" and never meant to advise any body to work an engine in this manner "after sufficient water had been turned on for five or six engines." With regard to engrossing the supply of water, see my letter at page 93. A Pedestrian, has given the diameter of the water-way of the posts erected by the New River Company, as 1¾ inches; all I have seen are 2 *inches;* but I must allow, that the size of those in the Grosvenor district, viz. 3 inches, is by far the most eligible.

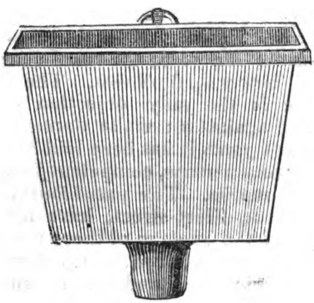
2dly. With regard to turncocks, a slight difference of opinion exists between us. I allow they are a serviceable class of men; but I would confine their services to regulating the supply of water to the inhabitants: in case of fire, the water should be derived *directly from the main*, and the firemen rendered *quite independent* of the turncock. "Pedestrian" says "every one likes to make his own engine most efficient, or at least to appear so." This is true: it is the universal feeling among firemen, and deserves encouragement; for it is to this good feeling, we must attribute, their active exertions, as well as their readiness to brave every danger; and it is to this good feeling that the inhabitants of this metropolis owe their comparative security.

3dly. "Pedestrian" is wrong in the dimensions of my proposed canal, he has quoted, viz. 2 inches by 4 inches. I gave this as the dimensions for the rose; the canal should be 6 *inches by* 6 *inches*. The expense is the only objection ever raised against it; while during the last five years it has been laid before numerous persons, competent judges of its merits. The parishioners of St. Bride, Fleet-street, have lately gone to the expense of those useless iron canals noticed in my former communication, and in which I also pointed out how they might be rendered serviceable to fire-engines, at a trifling additional expense. The cleansing of the canals should be the business of the scavenger, who, after sweeping the streets and carting the mud, should open a plug or firecock at the top of the street, and pass his broom down the length of the canal; thus, with a very little trouble, they might be kept clean. I cannot omit to notice the apathy and carelessness of individuals to every new improvement, as shown in the state in which most of the circular iron gutters which conduct the water across the pavement are to be found.

If the person who sweeps the front of the door-way (which, thanks to the Act of Parliament, he is obliged to do) every morning, would pass a stick along the opening left at top for that purpose, the gutter would be kept open; whereas, in eight cases out of ten, they are completely choked up with accumulated mud, and in the event of a heavy rain, the water from the tops of the houses overflows the pavement. Thus is this most admirable invention rendered a perfect nuisance, by the neglect of those persons

for whose convenience it was adopted.

A tank in front of each firecock, similar to those at the Horse-guards or the Temple, would be found superior to that recommended by "A Pedestrian;" drains would not be wanted, the water being used clean. I have a cistern of my own invention, shown in the accompanying sketch.



It is one foot six inches long, by one foot wide, and one foot deep, having a brass tube at the bottom to fit the fire-plugs, which met with general approbation; but has not yet been adopted by the firemen. Each engine should be provided with one of these portable cisterns; and on its arrival at a fire, a plug having been opened, the tube is to be put into it, when a body of water would be instantly collected in the cistern, from which two or three engines might work by means of their suction pipes; the overplus of water would flow over the top, and might be used by other engines in the present manner. The advantages would consist in getting the first engines instantly to work, without waiting for the breaking up of the paving. It would also furnish a good supply for buckets, which cannot well be obtained from a plug, unless a stand cock is at hand.

I hope "A Pedestrian" will find the above explanation satisfactory: should he not, however, I beg he will not be prevented from continuing his communications, by the fear of "being thought tiresome;" for I am of opinion with him, that we cannot have too much information on this head; and I cannot help flattering myself, at having (through the kindness of the Editor) brought forward this subject in the Mechanics' Magazine; for, to use the words of one of its writers (see vol. III, p. 205), "though a man possess but a small share of knowledge, yet he may be capable of conveying some useful discovery, or by chance acquire some secret of nature, or some useful intelligence of facts, of which more enlightened men may be ignorant." I shall conclude this subject in a future number, by the description of another plan for removing the inconveniences attending the present arrangements for supplying the fire-engines with water, and remain,

Your's respectfully,

WM. BADDELEY, JUN.

10, *George-yard,*
Lombard-street, Sept. 17, 1827.

ALE BREWING.

Sir,—As the great majority of your readers are, and must be, interested in this question, I have been gratified by perusing the letter signed T. T. in No. 206, and the plain, sensible remarks of A Cork Brewer, both which are evidently dictated by a desire to be practically useful. Will T. T. have the goodness to state how he manages the waste hops, and whether he puts them in dry or moist? I have used them always dried from the first worts, but confess that in *refining* I have no great opinion of their efficacy. When I have delayed brewing too long, and am obliged to get a cask ready for use at a short notice, I always use a little isinglass (the best), about half an ounce, boiled in a saucepan of water, which suffices for a cask of 30 gallons. When the fermentation has subsided, and just previous to bunging up, I pour this water and isinglass into the cask, put in my waste hops, and in one week can enjoy the luxury of a clear glass of beer. I have never yet tried the flour and salt, but intend to do so,

only hoping your friend *Globosum* will not be too angry. Allow me, however, to remark, *en passant*, that I think Globosum carries his antipathy to salt *rather* too far: so far as relates to salted meats, I can go with him, and can well imagine that nothing can be more unwholesome than meat which has been *hardened* by salt; but the *moderate* use of fresh salt cannot, I think, be otherwise than wholesome, or, if Globosum does not abhor a pun, *sal*-utary. For instance, now that we are all busy cracking nuts, will Globosum deny us a little salt with them, or with our bread, our butter, or our veal and potatoes? I have certainly read, but know not when or where, that in long voyages it was remarked, that fresh salt, used with old salted provisions, actually rendered the latter more wholesome; and that those who could be prevailed upon to use it were exempt from scurvy.

In conclusion, will you permit me to ask any of your readers who may be inclined to favour me with a reply, how they may have mananaged a brewing with *wheat* malt? All I know of wheat malt is, that I have heard it stated, several years ago, as producing ale of a very superior quality indeed.

I am, Sir,

Your obedient humble Servant,

*

St. Alban's, Sept. 22, 1827.

TO MAKE SIZE FROM POTATOES.

One of the beneficial uses of potatoes, not perhaps generally known, is that the starch of them, quite fresh, and washed only once, may be employed to make size; which, mixed with chalk, and diluted in a little water, forms a very beautiful and good white for ceilings. This size has no smell, while animal size, which putrefies so readily, always exhales a very disagreeable odour. That of potatoes, as it is very little subject to putrefaction, appears from experience to be more durable in tenacity and whiteness.

TO PRESERVE FRUITS THE WHOLE YEAR WITHOUT SPOILING.

Mix 1lb. of nitre with 2lbs. of bole ammoniac and 3lbs. of clean common sand: then, in dry weather, take fruit of any sort, which is not fully ripe, allowing the stalks to remain, and put them one by one into an empty glass till it is quite full; cover the glass with oiled cloth closely tied down; put the glass three or four inches down in the earth, in a dry cellar, and surround it on all sides to the depth of three or four inches with the above mixture. The fruit will thus be preserved quite fresh all the year round.

TO PREVENT ENGRAVED WOOD-BLOCKS FROM WARPING.

When the blocks are not in actual use, and especially after being wet, let them be taken out of the forms, or exposed to the air so as to dry equally on both sides. If taken out of the forms when wet, let them be set up on edge or end to dry, but not in the sunshine or near the fire.

Expensive blocks, intended to furnish a great quantity of impressions, ought to be washed with spirits of turpentine, and not wet with any thing else.

When blocks have already warped or sprung, place them on a damp cloth or paper for a few hours, with the rounding side up.

When straight, set them on an end to dry. Inexperienced or careless workmen are apt to leave them on the stone or elsewhere, with the bottoms very wet, and sometimes at least one-fourth immersed. This causes the bottom of the block to expand, while the face remains of the original size; of course it warps, and the ends become too high, and the first impression generally splits it; which the above suggestions, if attended to, will prevent.

MODE OF WRITING IN THE DARK.

We extract the following useful notice from the Monthly Repository

of Theology. "There are few persons of observation, who are not aware that the mind is more capable of ratiocination when awake in bed than at any other time, and who frequently regret their not being able to remember the ideas that have crossed their minds when undisturbed by visible objects. I apprehend this to be particularly the case with authors and men of letters; and by enabling them to write down their ideas in bed, with the least possible trouble, and no risk from fire, I shall, perhaps, render an acceptable service to some of your readers.

"The proposed method is, to take a slate of the smaller size used in schools, and rule parallel lines across, at about three-fourths of an inch distant. At the ends of each of these lines, perforate a small hole in the slate, and through these pass a piece of strong packthread, pulling it as tight as it will bear. In the spaces between these, as guides to the hand, a person with a little practice will soon be able to write legibly with his eyes shut, and he will then find no difficulty, when in bed, to write under the bed-clothes, without the trouble of dressing, or the fear of taking cold.

"I was induced to practise this method from seeing Mr. Holman, the blind traveller, write. A sharp pointed piece of pencil is necessary; and by boring holes in the frame of the slate for a moveable pin, the writer may always ascertain where he leaves off, and not write twice in the same place."

T.

PRESERVING APPLES FOR WINTER STORE.

Mr. Tollet, of Betley Hall, Staffordshire, in a communication to the Horticultural Society, recommends that apples, intended to be preserved for winter store, should be packed in banks or beds of earth like potatoes. This method is said to be at once effectual and economical.

EXPLOSION OF GUNPOWDER MILLS.

Iron has been excluded from powder works, in consequence of its giving out sparks when struck; and brass and copper have been employed in its stead, from an idea that they are free from this danger. It appears, however, from a series of experiments made by Col. Aubert, (Bull. de la Soc. d'Encouragement), that not only brass struck on brass, but even lead against lead, will inflame powder. May not many of the deplorable accidents which have happened at gunpowder mills have been owing to an ignorance of these facts? From none of Col. Aubert's experiments did it appear that iron struck against lead or wood would produce inflammation.

LIST OF NEW PATENTS.

Gabriel de Seras, of Leicester-square, London; Stacey Wise, and Charles Wise, of Maidstone, Kent, paper-makers; for certain improvements in sizing, glazing, or beautifying, the materials employed in the manufacturing of paper, pasteboard, Bristol boards, and other substances, communicated by a foreigner. Dated Aug. 21, 1827. *(Six months to inrol Specification.)*

John Hague, of Cable-street, Well-close-square, London, engineer, for a new method of working cranes, or tilt hammers. Dated Aug. 30, 1827. *(Two months.)*

NOTICES TO CORRESPONDENTS.

"Un ancien Elève de l'Ecole Polytechnique, qui a étudié les hautes mathématiques sous Mongé et la Grange" will please accept our assurance that the communications to which he alludes, though deferred, are not overlooked.

Communications received from Amicus —C. N.—J. C. H.—A Subscriber and Constant Reader—W. S. H.—Omikron —G. L. (Durham)—G. L. (Bath)— N. J. Andrew Whitesmith—A. B. W. —J. B. B.—J. W.

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Mechanics' Magazine,

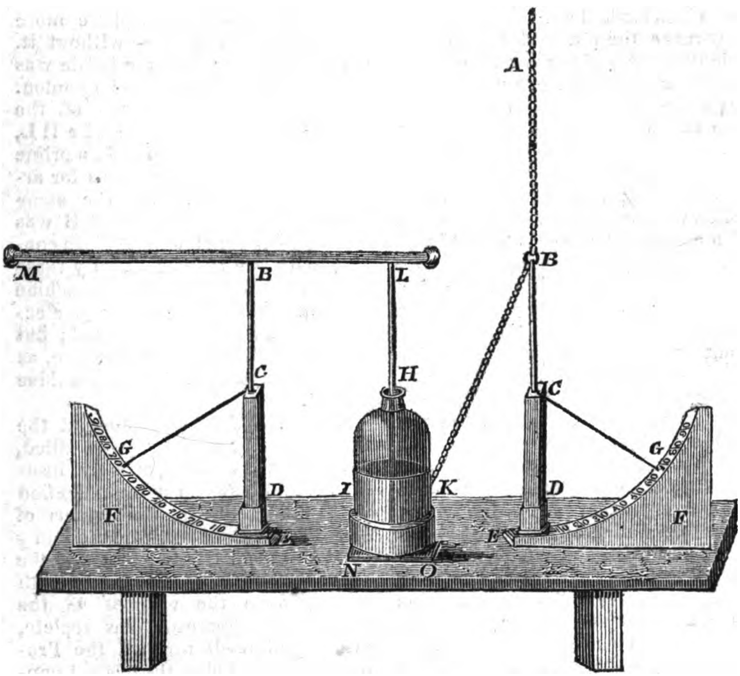
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 216.] **SATURDAY, OCTOBER 13, 1827.** **[Price 3d.**

"Through seas of knowledge we our course advance;
Discovering still new worlds of ignorance;
And these discoveries make us all confess,
That SUBLUNARY science is but GUESS;
MATTERS OF FACT to man are only known,
And what seems MORE, is mere OPINION."

SIR JOHN DENHAM:
(Progress of Learning.)

PROFESSOR RICHMAN'S ELECTRICAL GNOMON.



PROFESSOR RICHMAN'S ELECTRICAL GNOMON.

Sir,—As the electrical apparatus by which the celebrated Professor Richman lost his life has been lately adverted to in one of the Numbers of your Journal, the following description of it, as given in the Philosophical Transactions, may not prove uninteresting to your readers.

I remain, Sir,
Your obedient Servant,
J. J. LANCASTER.

"The description of Professor Richman's apparatus, as sent by himself to Professor Heinsius, of Leipsic, which he called an electrical gnomon.—To the construction of this gnomon were necessary, a rod of metal, a glass jar, a linen thread of a foot and a half in length, to one end of which was fastened half a grain of lead and a quadrant. The rod of metal C D was placed in the glass vessel E, which contained filings of metal. The linen thread C G was fastened to the rod at C, and when the apparatus is not electrized, hangs perpendicularly more than a foot and a half in length. And here must be added an account of the other part of the apparatus, which was to communicate the electricity to the gnomon during a thunder-storm. Through a glass bottle, the bottom of which was perforated, passed an iron rod, which was kept in its place by means of a cork fitted to the mouth of this bottle, through which cork likewise was inserted the iron rod. A tile was removed from the top of the house, and on this opening was placed the bottle, supported by the neighbouring tiles, in such manner, that one end of the iron rod was not only four or five feet above the top of the house, but the other end, which came through the bottom of the bottle, did no where touch the tiles, or any other part of the house. To this end of the iron rod was fastened an iron chain, which was conducted into the chamber of Professor Richman, on electrics *per se*, so as no where to touch the building. The entrance to this chamber faced the north; and at the south end of it there was a window, near which stood a table four feet in height. On this the Professor placed his electrical gnomon, and connected it with the chain, which was brought under the ceiling of the room over this table, and communicated with the apparatus on the top of the house by means of a wire B C, which hung from the chain, and was joined there to A B by the little ring B, and communicated with the rod D C at C. When the iron rod at the top of the house was affected by the thunder, or otherwise suitable condition of the atmosphere, the thread before mentioned deviated from the perpendicular, as it would also do if artificially electrized.

"Professor Richman sometimes added to this apparatus a glass bottle of water, H I, after the manner of Professor Muschenbroeck, adapted to a vessel of metal I K, placed on glass. The wire H L, from the mouth of the bottle of water, during the time of the thunder, he caused to communicate with B C. From this addition he found the electricity of the atmosphere more vehement than it was without it. On the left hand of the bottle was placed a second electrical gnomon. When this was made use of, the wire of metal B C, and the wire H L, were connected with M B L, a prime conductor from an apparatus for artificial electricity. At the same time, also, from the chain A B was fastened a piece of wire B K, in contact with the vessel I K. By these means, when the electrical machine was put in motion, both the electrical gnomons were electrized; but this went off, in a great measure, as soon as the motion of the machine ceased."

In Mr. Watson's opinion, at the time Professor Richman was killed, his apparatus was perfectly insulated, and had no communication with the earth, by the means of metallic or other substances readily conducting electricity; and that the great quantity of electricity with which, from the vastness of the cause, the apparatus was replete, discharged itself through the Professor's body, being the nearest non-

electric substance in contact with the floor, and was unfortunately the cause of his death. This, it is presumed, would not have happened, had the chain, or any other part of the apparatus, touched the floor, by which the electricity would have been readily communicated to the earth.

ON LIGHTNING CONDUCTORS.

BY WM. SNOW HARRIS, ESQ.

(Concluded from page 183, *No.* 215.)

Sir,—The cases of damage quoted by Lieut. Green, at p. 13, No. 204, for the purpose of showing that lightning rods are calculated to bring destruction on ships and buildings, will, on a fair inquiry, be found not only much misrepresented, but inconclusive authority for so violent an opinion. And first, with respect to the death of the celebrated Russian philosopher: of all other incidents, this is the last that should have been adduced in support of such an opinion, by any one professing to have examined the nature of electrical action. Professor Richman lost his life, not from the *presence*, but the *absence*, of a lightning conductor. The apparatus he employed, and which he termed an electrical gnomon, was exclusively a *collector*, and not a *conductor*, of electricity*—using the term conductor in the sense intended by Lieut. Green; and being insulated, "it bore the same relation to the electricity of the atmosphere, as the insulated conductor of an electrical machine does to the fluid generated by it: when, therefore it became charged by a thunder-cloud, it is not at all surprising, that by one of the dense sparks which passed from it, the Professor should have been killed; since we know the violent effects capable of being produced by an ordinary electrical machine." Hence it is not true that Professor Richman had a lightning conductor attached to his house; and it must be further evident, from what has been already stated, that every house in the town was at the same time receiving the electrical accumulation which exploded over it.

In quoting this case, the writer would have it inferred, that the effect of the thunder-cloud was exclusively confined to Professor Richman's house; whereas, in the account given in the Transactions of the Royal Society, we find "that people were stunned and struck down in the streets."

This is not the first time that Lieut. Green has mistaken the nature of the important question under consideration. In the year 1822, in a public print called the Nautical Register,* he actually proposes a somewhat similar apparatus in effect, to that employed by Professor Richman, for the purpose of defending ships against lightning; and whilst claiming the merit of this invention, and seeking to obtain a reward from the Society of Arts, with whom his model was deposited, he was at the same period endeavouring to show the folly and mischief of all such contrivances. His own description of it, which I now copy from the source above-mentioned, is as follows.—After some prefatory remarks, he says, "I completed fixed conductors to the model of H. M. Brig Resolute. These conductors secure the hull in great degree; pass round the hull outside, down the stern, into the water; the truck has a metallic globular top; the royal mast, as far as the top gallant mast head, is fitted with a conductor; at the top gallant mast head is an iron cross tree; it (speaking of the electric fluid) there exhausts itself at each end of it." Thus we perceive that a pointed metallic apparatus is raised into the air upon an imperfect conducting support, namely, the mast, which, in severe thunderstorms, would consequently become charged with atmospheric electricity, and inevitable destruction must be the consequence to all those placed near the cross tree. I should not have alluded to this matter, but

* See Transactions of the Royal Society, vols. 48 and 49.

* Nautical Register of October 20th, and December 11th and 18th, 1822.

for the purpose of convincing those into whose hands such a proposal may fall, of its evil tendency, as well as to show that Lieut. Green is by no means a person to be relied on, as authority against the fine invention of lightning rods.

And now with respect to the poorhouse at Heckingham, (p. 13). This case is quoted, as well as the former, from the Transactions of the Royal Society; and it occurred upwards of forty years since. The quotation, however, does not state *that a Committee of the Royal Society examined the premises, and declared the conductors to have been inefficiently applied.* But although this, as well as many other important points, are kept back, as in the case of the Plymouth church, yet we find an *addition* to the statement of material importance; namely, the words "most approved." In the original it stands thus:—

"Extracts from the Minutes of the Royal Society, Jan. 10, 1782. The President laid before the Council a letter to him from the Board of Ordnance, acquainting him that the poorhouse at Heckingham, near Norwich, had been struck by lightning, notwithstanding it was armed with eight pointed conductors:" after this a committee was appointed, who examined the premises; and the following is extracted from their report:—"The conductors were far from being so proper or fit as they ought to have been; being carried but a few inches below the surface of the ground, and dry, instead of being continued to many feet in depth, and ending in water or very moist earth, so as to render the conductors safe and effectual." Now, after this, I beg to ask how, with the least regard for a spirit of fair inquiry, any one can say that the building was armed with "the most approved" conductors?—seeing, as before stated, that a lightning rod, upon an insulated or imperfect conducting fuse, is really no conductor at all. The Committee further state the damage done, and they say, "One hip of the extreme corner of the building, at the *greatest distance* from the conductors, was struck and set on fire by a very loud explosion of lightning; but the fire was quickly extinguished, and *little* or *no damage* was sustained." I desire this may be compared with the quotation before alluded to.

The cases of the *Kent* and *Perseverance* (page 13), two ships said to be furnished with lightning conductors, and damaged by lightning, are given without reference to such authority as any one would reasonably demand; but, admitting the assertions to be correct, the facts avail nothing against the judicious application of lightning conductors on ship-board. It is allowed, by all those qualified to give an opinion on such an important subject, that ships are at present not properly guarded against lightning: instead of the conductors being perfectly continuous, they consist of metallic links, and when hoisted to the mast head, they often become detached and broken, more especially at night, when the ship is under sail, and when perhaps it is required to remove some of the higher masts and rigging, either by accident or design; and from the circumstance of their lower extremities being sometimes doubled up and secured in the rigging, as I have myself witnessed, they are frequently rendered very ineffectual; since the very nature of the application is, as before observed, to give the masts and rigging all the conducting power possible.

Such cases as those related may, therefore, possibly have happened: but, admitting this, still it would be very unreasonable to attribute the damage done to the lightning conductors, when, as already stated, such an immense number of instances have happened, in which ships and buildings have suffered, not furnished with lightning conductors at all, and many which had not even metallic spindles in the masts;* to say nothing of trees and rocks so frequently rent asunder by lightning. The fair presumption is, that the damage would still have been sus-

* See damage done to the sheer hulk at Plymouth.—*Transactions of the Royal Society*, vol. 49.

tained, if the lightning conductors had not been present, and perhaps to a much greater extent, seeing that numerous cases are on record in which buildings and ships have been protected by them. Moreover, before we adopt a hasty conclusion against the use of lightning rods, on such grounds, it is necessary to calculate the number of ships which *have been at sea* within a given time; and, in the same time, to estimate the number of ships, *without conductors, struck by lightning and damaged;* the number of ships equipped with conductors, which have escaped damage; likewise the number of ships, though struck by lightning, which have been *protected by them;* and lastly, the number damaged, though furnished with them: and when such points are determined, then I imagine the cases above alluded to will be of very little value as arguments against the general use of lightning rods at sea. A similar calculation should be entered upon for buildings on shore. In this country some thousands of conductors have been erected, and, in a great variety of instances, their utility has been very evident; whilst only two or three instances have happened, and those of a very equivocal nature, in which they have not afforded all the expected protection.

Such is the poverty of the arguments lately adduced to prove the fallacy of the views of the philosophers of the eighteenth century, and to show that lightning rods are calculated to bring destruction on mankind, although, for a period of at least fifty years, no such destruction has in consequence ensued; and, during which time, almost every powder-magazine in Europe, of any consequence, has been constantly guarded by them.

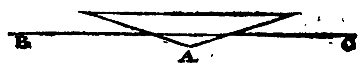
I have now to apologize to your readers for having trespassed so long on their attention.

I remain, Sir,
Your obedient Servant,
WILLIAM SNOW HARRIS.
32, *Union-street, Plymouth,*
September 20, 1827.

NAVAL ARCHITECTURE.—NOAH'S HYDROSTATICAL QUESTION.

Sir,—I now propose to examine the hydrostatical question proposed by Noah (p. 46, vol. viii.)

I supposed that every one knew that an equal weight, whether of iron or feathers, would immerse a vessel equally. Passing this by, however, we have a vessel supposed, which shall carry sixty tons of stone ballast:—in other words, supposing the vessel divided by a longitudinal section through the keel, we have 30 tons on each side of this imaginary section. Now, if the vessel be inclined, the stationary point in any horizontal plane will be the point where that plane cuts the longitudinal plane at right angles. Select, then, any point in the ballast, and that point will have one in the opposite section; which, acting at the end of a lever of the same length, *exactly* balances it. The only case in which this would be slightly altered, is, if we suppose the section of the vessel to be a frustrum of a cone, as A B C, where B C represents the water line. But even in this form, if deeply immersed, the action would be equal.

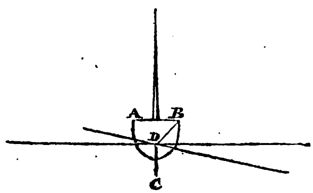


"Noah," seeing that the displacement of a vessel to leeward is increased by inclination, estimates this displacement as having a buoyancy equal to the force of the lever which inclines it. He ought to have said, that the ballast below the centre of motion is equal in force to the inclining lever.

Let me ask whether, in this vessel loaded with stone, supposing that the side immersed were broken through, the stones within would then sink or swim; for he may rely upon it, that they have no more tendency to "fly off to the weather side" when within the vessel's planking, than they would have if outside of it.

Let me now acquaint "Noah," that the principle which I advocate is well known to others, if not to

him. Some of the finest yachts at present afloat, as [the Arrow, 80 tons; the Miranda, 140; the Oberon, 40; and several others which I need not name, have iron keels to a considerable extent; and I doubt not the time will come when the prejudice will be done away with, and the difficulty of fastening so great a weight obviated. I do not, indeed, despair of seeing our men of war of some classes so fitted, especially as I have seen the principle recognized in the iron keelson of the Pylades, built by Sir R. Seppings,—no bad authority on this subject. With respect to "Noah's" vessel to be hauled alongside a wharf, &c. &c. I must make a remark.



Let a vessel, A B C, have 5 tons of ballast at C. Mark her centre of motion D, and then place a ton at B. The power of the ton at B will be to a ton at C, as B D is to D C, nearly. Now, as the vessel, by "Noah's" supposition, will be very light, the line D C will be very short, and of course the power at B great in proportion.

But this is merely such a case as that of trimming ballast to windward, the effect of which every one knows. If a ton were placed at A as well as at B, no power at all would be gained. I will, however, soon take an opportunity of trying this question with a small vessel; and you shall know the result. In conclusion, I beg to apologize to "Noah," if I have unwittingly offended him; for I will never designedly write any thing under an assumed name, to which I should hesitate to place my own.

PHILO-NAUT.

NEW STEAM ENGINE.

Sir,—I beg leave to acquaint you, that after considerable labour and long application, I have completed a steam engine, on a principle which, as far as I can ascertain, is altogether new. It is a reciprocating engine of extreme simplicity, in which the entire force of the steam is applied with equal intensity during the whole stroke; it does not, therefore, require a fly-wheel—all the expense and friction of which, together with that of the beam parallel motion, is saved. The entire engine does not weigh more than 30 lbs. per horse power, and the cost would not exceed £5 per horse; it also possesses the advantage of occupying a very limited space—very little, if at all, exceeding that occupied by the cylinder of the present engine. I am at present engaged in applying it to a carriage, which, from the result of experiments I have tried, I feel no hesitation in asserting I shall be able to perfect, at the rate of 10 or 12 miles an hour, on an ordinary turnpike road, if the frame work can bear that velocity; at all events, the strength of the frame is the only limit to the speed attainable. The model I have constructed, which of course is not in the best style of workmanship, has not cost above £50, although of 12 horse power. The peculiar principle of this engine has also enabled me to complete the design of a boat acted on by paddles of a new construction; which, it will be evident on a very slight inspection, will altogether avoid the injurious effects incidental to those at present in use. I should have no objection to treat with some person possessed of experience, and of sufficient means to bring this invention fully and fairly before the public, as soon as I shall have completed the experiments I am at present engaged in, which I calculate will be in about two months. Any person, in the mean time, wishing to communicate with me, may have my address from you, which I herewith send.

As it is to the perusal of your

most valuable and interesting publication that I am indebted for having first directed my attention to this subject, and also as it is from thence I have derived a large portion of the practical information which has enabled me to mature my plans, I think it but equitable that you should be the first to have the option of publishing a description, which I will take the liberty of forwarding, the moment I can do so with security to myself; in other words, so soon as I shall have secured my right by patent.

I am, Sir,
Your obedient Servant,
F. T.
One of your earliest Subscribers.

COTTON MACHINERY.
HARGRAVES AND ARKWRIGHT.

Sept. 4, 1827.

Mr. Editor,—Happening the other day to look through the second volume of your useful Magazine, I was surprised to see a letter signed "Argus," the writer of which, in endeavouring to set right the readers of the "Mechanics' Magazine," in the belief that *Arkwright* was not originally the inventor of the *spinning-jennies*, himself falls into a similar mistake; as he states in his letter, (page 255, vol. ii.) "the inventor to be a poor illiterate cabinet-maker, named Brown," who, in the act of shaving Arkwright, "suggested the basis of the invention." I must beg, however, to differ from "Argus;" as it is much more generally believed that this valuable invention was first discovered and brought into practice by a poor weaver, of the name of Hargraves, observing his wife's long wheel for spinning wool accidentally, or in a frolic, overturned; when it occurred to him that he could improve upon the method, with less labour, by making use of more spindles. At length, by dint of application, and setting the wheel in motion while it lay upside down on the floor, and placing in a perpendicular manner his spindles, to the number of twenty, he produced the machine called the *spinning-jenny*. It was left, however, to Arkwright to perfect what Hargraves had begun; he making the cotton pass through rollers, in a similar manner to what he had seen iron bars drawn out, in some iron works;—a degree of smoothness being thus attained which was previously unknown.

An early insertion of the above statement, in your impartial Magazine, will much oblige your old Subscriber and Constant Reader,

H. H. H.

Yorkshire.

We embrace the opportunity afforded by the letter of our correspondent, to extract the following additional and highly interesting particulars from an able article in a recent Number of the *Edinburgh Review*, "On the Rise, Progress, Present State, and Prospects, of the British Cotton Manufacture."

"The first improvement in the cotton manufacture was made by a person in humble life—James Hargraves, a carpenter at Blackburn, in Lancashire. This illiterate, but most ingenious and inventive person, adapted the stock-cards used in the woollen manufacture to the carding of cotton, and greatly improved them. In consequence, a workman was enabled to execute about double the work, and with greater ease, than by means of hand cards—the only instrument previously in use. Hargraves' inventions were soon succeeded by the cylindrical cards, or carding engine. The inventor of this valuable machine is unknown, but it was first used by Mr. Peel, the grandfather of the late Secretary for the Home Department. Mr. Peel's carding engine was constructed, with the assistance of Hargraves, as early as 1762. Sir Richard Arkwright added, at a subsequent period, many improvements to the carding engine; and his apparatus for taking off the cotton from the cards, and giving continuity to the fleece, is the most perfect that can well be imagined.

"But the tedious and expensive method of spinning by the hand, was the grand obstacle in the way of the extension and improvement of the manufacture. Insurmountable, however, as this obstacle must, at first sight, have appeared, it was completely overcome by the unparalleled ingenuity, talent, and

perseverance, of a few self-taught individuals. Hargraves, to whom we have already alluded, seems to have led the way in this career of discovery. In 1767, he had constructed a machine called a *spinning-jenny*, which enabled a spinner to spin *eight* threads with the same facility that one had been previously spun; and the machine was subsequently brought to such perfection, as to enable a little girl to work no fewer than from *eighty* to *one hundred and twenty* spindles!

"With the exception of Sir Richard Arkwright, perhaps, there is no individual to whom the manufactures of this country are so largely indebted as Hargraves. Never was the maxim—*c'est le premier pas qui coute*—more completely verified than on this occasion. It is true that his machine was of very inferior powers to those by which it was immediately followed. But it is not, perhaps, too much to say, that it was one great cause of their being introduced. No sooner had it been seen what a simple mechanical contrivance could effect, than the attention of the most ingenious individuals was immediately drawn to the subject; and the path was opened, by following which so many splendid inventions and discoveries have been made.

"But however much Hargraves' inventions may have tended to enrich others, to himself they were productive only of bankruptcy and ruin. The moment the intelligence transpired that he had invented a machine by which the spinning of cotton was greatly facilitated, an ignorant and infuriated mob, composed chiefly of persons engaged in that employment, broke into his house, and destroyed his machine; and sometime after, when experience had completely demonstrated the superiority of the jenny, the mob again resorted to violence, and not only broke into Hargraves' house, but into the houses of most of those who had adopted his machines, which were everywhere proscribed. In consequence of this persecution, Hargraves removed to Nottingham, where he took out a patent for his invention. But he was not, even there, allowed to continue the peaceable enjoyment of his rights. His patent was invaded, and he found it necessary to apply to the Courts for redress. A numerous association was in consequence formed to defeat his efforts; and being, owing to a want of success in an attempt to establish himself in business, unable to contend against the wealth and influence of the powerful combination arrayed against him, he was obliged to give up the unequal contest, and to see himself robbed of the fruits of his ingenuity. He soon after fell into a state of extreme poverty; and, to the indelible disgrace of his age and country, was permitted to end his days, even after the merit of his invention had been universally acknowledged, in the workhouse at Nottingham!*

"The invention of the spinning-jenny has been ascribed by Mr. Guest, in his very meagre, prejudiced, and superficial work on the History of the Cotton Manufacture,† to a person of the name of Highs or Hayes, a reed-maker in Bolton. But he has not produced a tittle of evidence to show that Hargraves knew anything of Highs; and as he is admitted on all hands to have been the first who made the invention public, we do not see the shadow of a ground for attempting to deprive him of the honour of the discovery.

"The jenny was applicable only to the spinning of cotton for weft, being unable to give to the yarn that degree of firmness and hardness which is required in the longitudinal threads or warp. But this deficiency was soon after supplied by the invention of the *spinning frame*—that wonderful piece of machinery which spins a vast number of threads of any degree of fineness and hardness—leaving to man merely to feed the machine with cotton, and to join the threads when they happen to break. It is not difficult to understand the principle on which this machine is constructed, and the mode of its operation. It consists of two pairs of rollers, turned by means of machinery. The lower roller of each pair is furrowed, or fluted longitudinally, and the upper one is covered with leather, to make them take a hold of the cotton. If there were only one pair of rollers, it is clear that a carding of cotton, passed between them, would be drawn forward by the revolution of the rollers, but it would merely undergo a certain degree of compression from their action. No sooner, however, has the carding or *roving*, as it is technically termed, begun to pass through the first pair of rollers, than it is received by the second pair, which are made to revolve

* See the Case of Richard Arkwright and Company, in 1782.

† Mr. Baines has taken almost all his statements with respect to the history of the cotton manufacture from Guest,—a circumstance that detracts considerably from the value of his work.

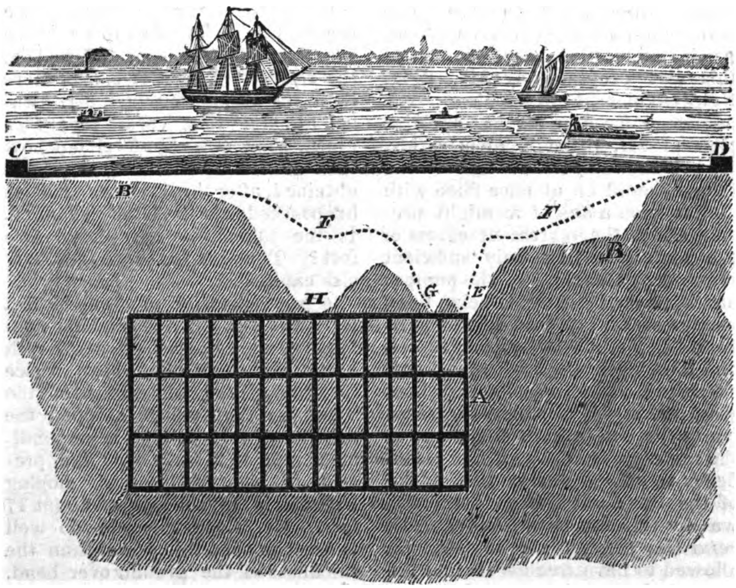
with (as the case may be) three, four, or five times the velocity of the first pair. By this admirable contrivance, the roving is drawn out into a thread of the desired degree of tenuity—a twist being given to it by the adaptation of the spindle and fly of the common flax-wheel to the machinery.

"Such is the principle on which Sir Richard Arkwright constructed his famous spinning frame. It is obvious that it is radically and completely different from the previous methods of spinning either by the common hand-wheel or distaff, or by the jenny, which is only a modification of the common wheel. Spinning by rollers was an entirely original idea; and it is difficult which to admire most—the profound and fortunate sagacity which led to so great a discovery, or the consummate skill and address by which it was so speedily perfected and reduced to practice."

THE THAMES TUNNEL.

A small book of sketches has just been published, by the authority of the Directors of this undertaking,* for the purpose, chiefly, of furnishing the public with more correct information than it has yet had before it, of the nature and extent of the accident by which the work was recently interrupted.

The substance of several of these sketches we have here combined in one.



A represents a transverse view of the iron frame-work or shield, which covers the whole front of the excavation, and in the twelve divisions of which the miners and bricklayers pursue their labours.

E, the opening, about 5 feet by 2 feet 6 inches, by which the water rushed in upon the 18th of May last, and filled the whole of the works.

The dotted line F F shows the state of the bed of the river as it was found immediately after the accident.

The cavity E had been nearly filled with bags of clay, when the ground in another part (either G or H, it is not stated which) also gave way; and in consequence of this new irruption, and the constant eb-

* "Sketches and Memoranda of the Works for the Tunnel under the Thames, from Rotherhithe to Wapping."

bing and flowing of the river, the bed of the river was washed away to the farther depth of the line B B.

The whole of the cavity C D H E has now been filled up by bags of clay with gravel intermixed; over this there has been laid a thick tarpauling (from C to D), which is kept down by cast-iron kintledge; and, above all, there is a covering of gravel, "forming altogether a solid mass impenetrable by the river."

It is estimated that above 1000 cart-loads of loose soil and rubbish (equal to 1000 tons) descended into tunnel, of the whole of which it has now been cleared

It will be observed, that but for the wearing-down effect of the constant ebb and flow of the river after it broke through, the damage done would not have been nearly so great. An ingenious plan to put a stop to this was proposed by Mr. Peter Keir, engineer, Camden Town, but neglected for a much less effective plan of Mr. Brunel's own.* Mr. K. proposed that the shaft of the tunnel should be at once filled with clay to such a height as might prevent either the ingress or egress of the water, leaving only sufficient room for the suction of the pumps; and that, on the hole E being filled up, the water enclosed in the horizontal tunnel should be pumped out, and the clay in the shaft afterwards extracted. Mr. Brunel's expedient was, to apply a steam-engine to pump the water from the shaft, in the same proportion as it had a tendency to escape during the ebbing of the tide: but though the water was by this means prevented from *returning* through the hole, it was allowed to have free access into the shaft during the rise of the tide; consequently, but one half of the mischief was avoided.

Great anxiety is shown by the writer of the "Memoranda" before us, to persuade his readers that, notwithstanding the accident that has occurred, "the works for the tunnel have not in any way disturbed the original bed of the river,"—that is, literally speaking, that you may remove 1000 cart-loads of soil from a single spot in the bed of a river, without in the least disturbing it! What the writer, we presume, really means to intimate, is, that the accident has had no sensible effect on the navigation of the river; and this, we believe, is the fact.

The strata through which the tunnel has been excavated, is stated to have dipped uniformly at the rate of 1½ per cent. and the tunnel itself at the rate of from 3 to 1½ per cent.; so that, at the point where the water broke in, which was about 500 feet from the shaft, the excavation was about six feet deeper in the strata than at starting.

"The top of the excavation," we are told, "is intended to be never less than 14 feet from the bed of the river." This is two feet more than the minimum which Mr. Brunel at first took credit for; (see Mech. Mag. vol. i. p. 66;) but how this desirable addition has been obtained, after the line of excavation has proceeded so far, is not explained. Is the tunnel to step down two feet? The idea is absurd; but how else can it be?

A superstratum of even 14 feet furnishes but little ground for confidence, where holes of such depth occur, as those that have twice interrupted the tunnelling of the Thames: that which stopped the drift-way in 1809, was a perpendicular hole of 9 feet deep; the present is represented as sloping irregularly to a depth of about 17 feet. Mr. Brunel would do well to trust to something else than the thickness of the ground over head, if he expects to bring his undertaking to a successful conclusion. We have before (pp. 365, 397, vol. vii.) pointed out the expediency of adopting some sort of artificial shield, that shall secure the works from inundation throughout the whole of their progress, whatever may be the nature of the soil cut through; and we are sorry not to find in the publication before us the least assurance that any plan of this kind is in contemplation.

* A very good plan for the purpose was also proposed by a correspondent of our own, p. 415, vol. vii.

Mr. Brunel seems to think it enough that he has succeeded in stopping up one hole, to justify him in soliciting his constituents to go along with him in running every risk of a second.

At a recent meeting of the shareholders of this concern, it was admitted that the money in hand is reduced to £25,000; and that this, with any additional sum which can be raised under the Act of Parliament, is wholly insufficient for the completion of the tunnel. The width of the river at this place is, from wharf to wharf, 1000 feet; and the projected width of the tunnel, from shaft to shaft, about 1300 feet. Only 550 feet of the tunnel were completed when the water broke in; leaving 750 feet still to be excavated. Under these circumstances, the Directors confess that they rested their only hope of finishing the work, on obtaining the assistance of Government; or, in other words, a gift out of the public purse, to make up for the deficiency in their own.

That Government would do well to refuse such assistance, we are far from affirming; but we think it probable, that before granting it, they will feel it their duty to have satisfactory answers to a few such questions as these:—

How does it happen that the past expenditure has already so far exceeded the estimates on which the Act of Parliament proceeded, that little more than a *third* of the work has been executed with the money provided for the *whole?* Is it owing to the irruption of the water, that so much extra expenditure has been occasioned? And, if owing to such irruption, what surety is there that similar accidents may not again occur?

It deserves to be recollected, that when Mr. Brunel has been blamed for the present interruption to the works, as establishing a failure in his calculations, his constant answer has been that "there was nothing in it, for that it was what he had from the first anticipated." If, therefore, it was anticipated from the first, it can have had but a small share in occasioning this great difference between the estimates and actual expenditure.

But we put, in truth, no stress whatever on what Mr. Brunel has advanced by way of apology on this occasion. We do not believe that he really anticipated any such accident as has occurred; and we are quite certain that we do him less injury by saying so, than if we were to agree with Mr. Brunel himself in asserting that he did fully anticipate the accident, and yet took no step to guard against it. At the special general meeting of the Proprietors, held on the 19th of June last, Mr. Brunel observed that "the last bricks which had been used, were, he feared, *too green*, and had not presented sufficient resistance to the water." (See Mech. Mag. p. 397, vol. vii.) In saying this, Mr. B. did as much as assert, that if the bricks had *not* been so green, the water might have been kept out; and that it was to their resistance he trusted, in the event of any such accident: but will he in as many words positively affirm that if the bricks had been as firm, as dry, and as old, as the oldest granite itself, they could have prevented the water from rushing in amongst them as it did? The fact is, Mr. Brunel is alike out in his calculations, and out in his explanations; he offers one reason, and now another, by way of apology: just after the manner of a man who knows not what to say, and yet thinks he must say something. He would have better consulted his reputation, and been not less sure both of public sympathy and support, had he said nothing at all, and left the facts to speak for themselves.

[A paper, on the subject of tunnelling, by Mr. Carey, in our next or ensuing Number.]

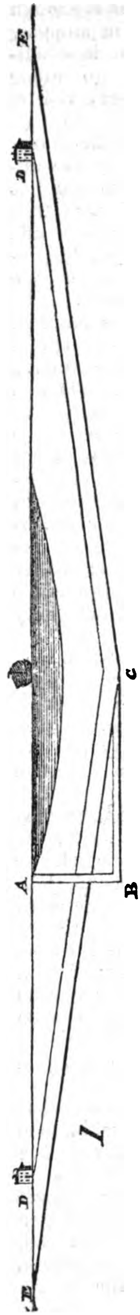
IMPROVED MODE OF TUNNELLING.

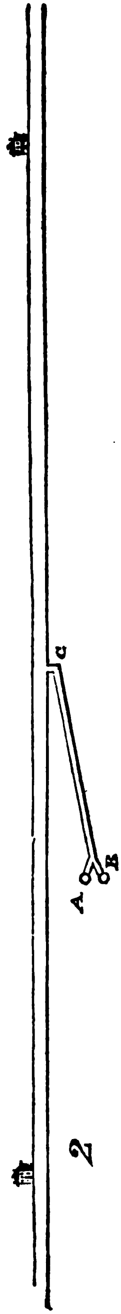
BY MR. THOMAS DEAKIN, OF BLAENAVON IRON WORKS.

[In laying this ingenious communication from an old miner before our readers, we may be excused for pointing out to their attention the

strong coincidence between it and the opinions we have expressed on the subject of the Thames Tunnel, particularly at pp. 397, 398, vol. vii. There is in our minds no question, that *want of depth* has been the radical error in Mr. Brunel's case, as in most others of the same kind. EDIT.]

Sir,—Driving tunnels under rivers in this kingdom has till now proved a difficult task. To me, who am an old miner, the reason appears obvious; and it is this—the not taking sufficient depth to encounter any obstacle in the centre, or whatever part may be the deepest in the bed of the rivers. The plan usually adopted hitherto, has been to sink shafts on the river sides (as in the instance of the Thames Tunnel), barely deep enough to clear the bed of the river; and, in general, the working has gone on tolerably well until the excavators neared the middle of the river, and the covering over head became so thin as to tumble in upon them. I now send you a plan, which offers a more practical method, a handsome tunnel, and which can be completed in a shorter distance than any tunnel that has been yet attempted to be made under rivers in this kingdom. I propose to commence tunnelling under the middle (or the deepest part) of the river, and at 50 feet below its bed. I would first sink an 8 feet shaft from A to B, (see fig. 1,) and then drive an 8 feet drift from B to C. The latter I would floor with air tight planking, raised 3 feet above the sheeting in the bottom of it, in order that air might be conveyed beneath from the engine shaft A, on the ground plan, fig. 2. On this planking I would lay the tram road, by which the spoil should be carried from the tunnel to the shaft B, fig. 2. It will be necessary, you will observe, to have two shafts: one for airing the tunnel, and the other, which may have stairs in it, for drawing up the spoil and pumping out the water. The air descends the engine pit, goes under the planks to the tunnel at C, returns over the planking, and ascends the bye pit.





The tunnel then commences at C, towards both ends, at the same time rising 1½ inch in a yard, and beginning with a head covering of 50 feet between it and the water. As the tunnel proceeds, its distance from the water will increase, because the bed of the river will most probably rise more than 1½ inch in a yard towards its banks. A tunnel thus rising on each side from the middle, and opening quite out at each end, must, I think, appear handsome when completed.

I suppose, for example sake, that at high water there is 30 feet of water in the river: from the bed of the river to the crown of the arch there will be 50 feet of earth; the tunnel itself will be 20 feet; making in all 100 feet from the top of the water to the bottom of the tunnel. By rising 1½ inch per yard, the whole underground length of the tunnel will be 1300 yards, or 650 yards on each side from C to D, where, if the surface is not higher than high-water, the crown of the tunnel will go out. The bottom will end 150 yards forward on each of the open works from D to E. The whole length from E to E will then be 1600 yards. When the tunnel has been completed, let the planking be removed from A to C in the 8 feet drift, fig. 2, and what water there is in the tunnel will then be conveyed down this drift to the pumping engine. If two tunnels are required to complete the travelling convenience, let them be 20 yards apart, and connected by openings of 8 feet diameter, at convenient distances. The open parts from D to E should, in that case, extend the whole breadth of both tunnels, and thus form a *spacious opening or square of* 100 *feet* at each end of the tunnel.

My plan for mining the tunnel is with iron boxes, so contrived that, when in their places, they will form a centering for the mason-work in the tunnel. No part of the breast, sides, top, or bottom of the tunnel, will have more than 18 inches of opening in breadth, or merely as little as the miner can work in; and the openings, small as they are, can be stopped in a moment: the boxes will be firm against the breast of the work, and prevent its heaving towards the miners, which is the particular danger in tunnelling.

I am, Sir,
Your obedient Servant,
THOMAS DEAKIN.

Blaenavon Iron Works,
July 21, 1827.

DELETERIOUS PROPERTIES OF LEADEN PIPES—EXPERIMENT OF MR. FARRADAY.

Gloucester Place, Oct. 3, 1827.

Sir,—Permit me, as a subscriber to your valuable Magazine, to solicit the attention of your scientific readers to a subject in which the public is deeply interested.

The deleterious properties of lead are well known; yet pipes of this dangerous metal are most extensively used for conveying fluids, even those which form a part of our diet: for instance, all the beer which is drawn in our taverns and public-houses, passes from the cellar to the bar through long leaden pipes. These pipes soon become coated, internally, with acetate of lead, a deadly poison; the beer, passing over a continued surface of this poisonous matter, for 20, 30, or 40 feet, absorbs more or less of it, in proportion to the state of the pipe and the acidity of the beer. The habitual use of beer thus drugged, produces painful and dangerous disorders. In summer and autumn, when the exciting causes are most powerful, the effects are obvious in the great prevalence of stomach and bowel complaints. Many hours must elapse between drawing the last beer at night and the first in the morning; the beer which remains all this time in a leaden pipe, must be so strongly impregnated with the poison, that, under particular circumstances, it may be the direct cause of death. Some publicans are said to be aware of this, and to avoid the extreme case, by drawing off a certain quantity every morning, which they throw into their waste butt.

A small leaden pipe was taken from a public-house, where it was

actually in use; a piece of this pipe, less than six inches long, was found, by Mr. Farraday, of the Royal Institute, to contain sixty-seven grains of deposit, which, being analyzed by that distinguished chemist, proproduced thirty-seven grains of acetate and sub-acetate of lead. Some of your scientific correspondents may possibly be able to remedy, or at least qualify, an evil so important, and so much at variance with the spirit of the age.

I am, Sir,
A Subscriber
and Constant Reader.

CASE-HARDENING IRON.

Pure iron, when surrounded by and in contact with cast-iron turnings, and heated, is carbonized very rapidly, so as to harden, to temper, and, in fact, to exhibit all the properties of steel. M. Gautier, in a paper in the *Journal de Pharmacie* for 1827, p. 18, states that he has found this a very advantageous process in numerous cases, especially where the articles to be case-hardened, or converted into steel, are small, as iron wire or wire gauze. The temperature required is not so high as that necessary in the ordinary process of cementation, and the pieces carbonized are not at all injured in form. The kind of cast-iron used should be the grey metal; and the more minutely it is divided, the more rapid and complete is the operation. By covering the mass of cast metal in which the iron to be carbonized is enveloped, with sand, oxidation from contact with the air is prevented, and the cast metal may be used many times.

TO DEFEND THE ROOF OF A HOUSE FROM THE WEATHER AND FIRE.

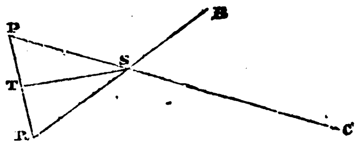
Take one measure of fine sand, two measures of wood ashes well sifted, three of slackened lime ground up with oil laid on with a painter's brush, the first coat thin, the second thick.

I painted on a board with this mixture, and it adhered so strongly to it, that it resisted an iron tool and the operation of fire. I used only a part of it, and leaving the rest in an iron pot, left it with water on its top, which is now as hard as stone, and not in the least altered by the effect of the water.

S.

METHOD OF FINDING AN ANGLE BY HELP OF A CHAIN AND STICKS.

BY MR. W. SHIRES, MATHEMATICAL TUTOR.



Let C and B be two objects, viewed from the station S. To find the angle C S B, plant a stick at S, and from S, in directions from the objects C and B, measure S P and S R, each 10, or one chain; also measure P R: hence we have the three sides of an isosceles triangle P S R.

Now take one half the base P R, and find the degrees and minutes answering thereto in a table of natural sines, which (arch or) angle being doubled, gives the required angle B S C; for, calling P S and S R radii, P T or T R, either is the sign of half the angle P S R, which angle is also equal to the angle C S B, (see Euclid, 15, book 1st); and the respective ratios are those of equality: hence the angle thus found is correct.

TO KEEP OFF, OR DRIVE AWAY, BUGS.

Make a strong decoction of red pepper, when ripe, and apply it with a common paint brush to the joints of the bedstead, wainscotting, &c. where these insects usually resort, and it will speedily kill, or expel them. There is a vast quantity of wood from America, annually imported, which is full of the eggs of these insects, and therefore ought to be particularly avoided as to in-door work.

TO PREVENT SNOW-WATER PENETRATING BOOTS AND SHOES.

Take equal quantities of bees wax and mutton suet, and melt them together in an earthern pipkin over a slow fire. Lay the mixture, while hot, over the boots and shoes, which ought to be made warm also; let them stand before the fire a short time for it to soak in, and then put them away until they are quite cold. When they are so, rub them dry with a piece of flannel, in order that you may not grease your blacking brushes. If you black them well before the mixture is put on, you will find them take the blacking much better afterwards.

DURABLE PAPER.

Plunge unsized paper once or twice into a clear solution of mastic in oil of turpentine, and dry it by a gentle heat. The paper, without becoming transparent, will have all the properties of writing paper, and last for years without being injured, either by damp, mice, or insects. This process, which we quote from a German journal, is stated to have been communicated by M. Engle. It is added, that if a solution of caoutchouc is used, a still more durable paper will be obtained.

VARNISH FOR IRON AND STEEL.

A permanent varnish is obtained by rubbing iron, in a state nearly red hot, with the horny hoofs of cattle, previously dipped in a small portion of oil. This process is asserted to afford the best defence from the influence of air and humidity.

LONDON MECHANICS' INSTITUTION.

NO. XII.

"Things to be remembered."

Lectures.

Wednesday, Sept. 19. Mr. Downes, a lecture on Magnetism as applied to Navigation.

Friday, Sept. 21. Professor Millington commenced his lectures on Hydrostatics and Hydraulics. Introduction; Fluids to be considered; Water; the Florentine and other Experiments; Perkins's Pezometer; Compressibility of Water; Effect of Gravitation on Fluids; the Balancing Properties of Homogeneous Fluids; Law of Floating Bodies; Hydrostatic Paradox; Bramah's Press.

Wednesday, Sept. 26. Mr. Downes, on the Method of Finding the Longitude of Places.

Friday, Sept. 28. Professor Millington on Hydrostatics; Principle of Bramah's Press; Hydraulic Bellows and Forcing Pump; Law of Fluids; Magic Fountain; Diving Bell; Steel's Bell; Advantages of a Knowledge of Specific Gravity; Alloyed Gold; Archimedes.

Professor Millington, at the conclusion of his admirable lecture, informed the members that it had been his intention to extend his course; but, in order to accommodate Mr. Wallis, he should close his lectures on hydrostatics next week, and that he would again appear before them on the next open night. The worthy lecturer, who is universally esteemed, retired amidst those hearty plaudits which ever attend him at this Theatre.

Mr. Wallis will very shortly commence a course of lectures on Astronomy; and at their conclusion, Dr. Birkbeck is expected to conclude his lectures on Anatomy.

The roof of the Theatre, which for some time past has been observed to sink, is now undergoing a thorough repair, under the able management of Professor Millington. To this circumstance he adverted on Friday, the 21st, and assured the members that *danger* was not to be apprehended. It is supposed that the *expense of repairs* will amount *to a sum little short of* £200!! In some quarter or other there must certainly have been either culpable negligence or an extreme want of judgment. Here is a theatre, which has been erected at an expense of near £5000, and has stood for not two years and a half, and yet in that time its roof, from an evident deficiency in its construction, requires a large sum to prevent it from falling in. What sort of explanation can be given, it is difficult to conjecture; for the building Committee* was composed of scientific men, and they had the advantage of a combination of practical knowledge founded on the sure basis of experience. The interests of the Institution are intrusted to the care of the Managers, and, in taking their

* It may be proper to mention that Professor Millington had no hand in the building of the theatre.

stewardship, they should ever bear in mind that though not paid in money, they are still accountable for any error which they may commit. The case speaks for itself: and, as the power lies in the hands of the members at large to call General Meetings, I do not think that they can exercise that power better than by doing so now; in order that some means may be devised whereby the usual funds shall not be injured in consequence of this unexpected heavy expense, and that the Committee may have an early opportunity of clearing themselves from the charge of mismanagement.

The number of members, as will be seen by the Reports, is fast dropping; no sign of improvement has appeared; and although the receipts have exceeded the amount of the corresponding quarter in last year, yet, if the dropping off does not abate, it is generally feared that all will drop together. That this diminution in the number of new members is to be ascribed to the half-crown entrance money is admitted by all parties; for, on reference to every previous quarter, it will be seen that the Institution was, in this respect, fast improving. In the June quarter of last year, the admission of new members, after deducting the loss of those who had ceased paying, left a clear balance in favour of the Institution. The number then was 1699, the number who ceased paying was 397, new members 574. I have not the Report for the September quarter by me; but I have no doubt it would show a corresponding result. The Committee being aware of all this, it is astonishing that they should continue the system any longer; and still more surprising is it, that they should not be able to find lecturers who are worth paying for. However true it may be, that what Mr. Preston advanced was sound science, yet his lectures were far from attractive, both in ability and the other requisites so necessary for a public speaker. The Committee have had two or three severe practical lessons in the lecture department; so that it is to be hoped they will now learn to be more discreet.

It was proposed by a member, as a means of recruiting the funds of the Society, that prospectuses, pointing out the benefits to be derived from joining it, should be given out at public buildings, and other places where many workmen were employed, in order that they might be better informed of the existence of the Institution. This sensible and economical mode of advertising was opposed by Mr. M'William, because he thought would be *derogatory* to the *respectability* of the Institution. It is a pity that such a pride should have a tendency to check a good plan; for *where* the dishonour would lay, it is difficult to determine: it is bad enough to be poor, without making it worse by being proud.

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LIST OF NEW PATENTS.

Benjamin Merriman Combs, of Birmingham, ironmonger, for improvements on, or additions to, a pulley, machinery, and apparatus, used and applied for securing, fixing, and moving curtains and rollers, and other blinds. Dated Aug. 30, 1827. *(Two months)*

William Dettmer, of Upper Mary-le-bone-street, London, pianoforte-maker, for improvements on pianofortes. Dated Aug. 30, 1827. *(Six months.)*

William John Ford, of Mildenhall, Suffolk, farrier, for improvements in the make, use, and application of bridle-bits. Dated Sept. 6, 1827. *(Two months.)*

George Clymer, of Finsbury-street, London, engineer, for an improvement in typographic printing, between plane or flat surfaces. Dated Sept. 6, 1827. *(Six months.)*

Errata in the Account of the Frigorimeter, page 107.

Column 2, line 1, for "the *circular* index," read "the index"—col. 3, line 9, for "bar *is* again," read "bar again"—col. 3, line 11, for "*spring*" read "string"—for "frigorific mixtures and bars," read "frigorific mixtures and metallic bars." The upper part of the engraving, fig. 1, should have been drawn higher, so that the wheel W should not interfere with the spring S. In fig. 3, M is drawn as a *pinion*, into the leaves of which the teeth of the wheel P work; whereas M is the *axle* of the wheel N, and P works in R only, which is turned by it.

NOTICES TO CORRESPONDENTS.

J. F. B. shall have every attention paid to his wishes.

J.—Yes.

Communications received from T.—Amicus—A Young Mechanic—Mr. Saul—G. S.—Jn. A——d—J. S.—Aurum—P. H.—J. B. B.—A. B.—Peter.

Part 54 is just published.

Part 55 will be published Nov. 9, and Part 56, Nov. 30.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

Printed by Duckworth & Ireland, 76, Fleet-st.

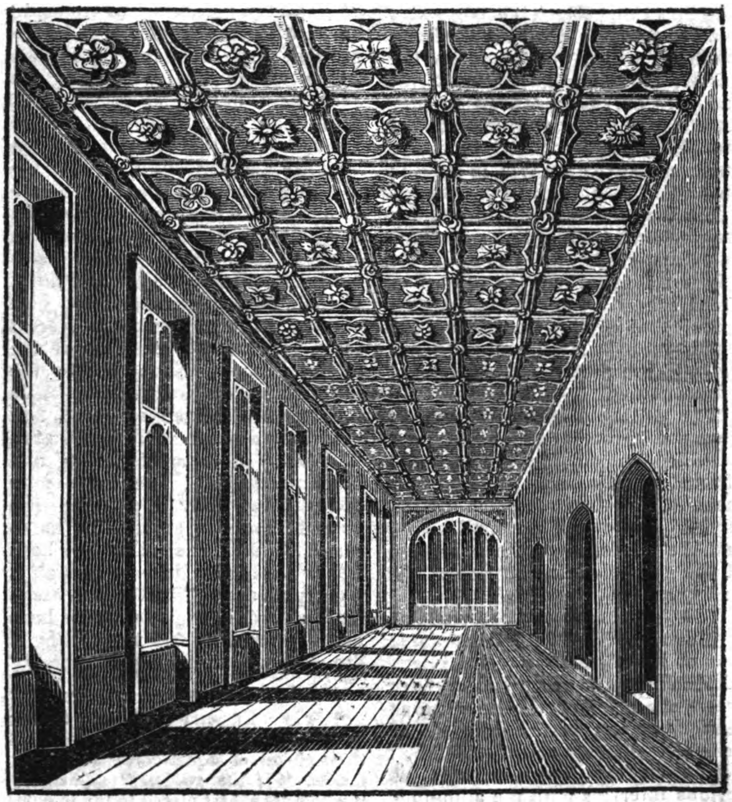
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 217.] SATURDAY, OCTOBER 20, 1827. [Price 3d.

"The labours of men of *genius*, however erroneously directed, scarcely ever fail in ultimately turning to the solid advantage of mankind."

MRS. SHELLEY.

LONG GALLERY, WINDSOR CASTLE.



IMPROVEMENTS AT WINDSOR CASTLE.

(From the Communications, chiefly, of Mr. C. Davy.)

NO. IV.

Long Gallery.

The reader has been already informed that the eastern side of the palace, of the exterior of which a full view was given in our 215th Number, is wholly occupied by the King's private apartments. Along the rear of these, fronting the interior quadrangle, there runs a handsome corridor; and over this is the Long Gallery, of which we now present our readers with a perspective view.

The length of this gallery fills a beholder with instant astonishment. The only thing which it occurs to his mind to compare it with is the Long Walk by which you approach the Castle; it seems, indeed, as if art had here purposely strived to produce a parallel to that magnificent avenue. The Long Gallery is five hundred and twenty feet in length; an extent of artificial construction which may be allowed to stand a comparison with any thing of which landscape gardening can boast. We think we may venture to assert, that, though there are several longer galleries (that of the Louvre is 1450 feet), *so long a walk*, and *so long a gallery*, are nowhere else to be met with together.

The ceiling of this gallery rises from a rich cornice on each side, and is divided, by mouldings of a very bold character, into square compartments, the centres of which are occupied by pateras of various designs; and the whole, with the exception of the groundwork, is richly gilt and burnished.

The great doors, as well as windows, are filled with plate-glass; and of the former we feel particularly called on to remark, that finer specimens of joinery we have never seen—they are perfect models of geometrical nicety and high finish.

The gallery communicates at various intervals with the adjoining apartments of His Majesty, and with the staircases of the several towers. At the south-east angle, where there is a private entrance for the King, a new staircase has been constructed by Mr. Wyattville, which may, without exaggeration, be termed a gem of art. Certain localities made it necessary that it should be of a triangular form; but the difficulties of such a construction Mr. W. has overcome with infinite judgment and skill.

We said, in our last notice, that the interior of the palace would be found in "perfect harmony" with its exterior; but, in pronouncing this opinion, we referred chiefly to the size and commodiousness of the apartments, as compared with the small and inconvenient rooms common to all ancient Gothic castles. The "harmony" is by no means in *all points* so "perfect" as we could have wished. There are incongruities and redundancies in the inside ornaments, such as the chasteness of the exterior would little lead you to expect. The Long Gallery and Stair-case which we have just described, as also the Waiting Room and Music Room, are to our minds unexceptionable; but in the more private apartments of His Majesty, there prevails such a mixture of pure Gothic and florid French, as we apprehend can give satisfaction to no person of correct taste. It would seem as if the foreign mania, which led to the introduction of French windows in the reign of Charles the Second, had not wholly departed with the Stuarts. The *locale* of these blemishes, and more particularly the very pure taste which Mr. Wyattville has elsewhere displayed, incline us to suspect that he has not always been *left to himself*. He has, probably, like Apollodorus, had those to assist him in his designs, who would have been better occupied in painting a fire-screen, or designing a brocade.*

* The Emperor Adrian, having designed a pavilion or temple, requested the opinion of Apollodorus as to its merits. "If the goddess," replied he, "whom thou hast placed in thy temple, should wish to rise and take an airing,

REVIEW OF PAPERS ON RAILWAYS.

Sir,—The subject of railroads having been alluded to by your correspondents B.C. (page 35, vol. viii.) and S. Y. a Young Engineer (page 68, vol. viii.), has induced me to look over the different papers which have appeared in the Magazine on that subject. Among the numerous correspondents who have amused us with their opinions on the doctrines put forth in the original essay, from the *Scotsman*, James Yule and S. Y. are the most prominent. The first is the only supporter of that essay; and the second the most strenuous in his opposition, and the only one who has attempted to support his argument by mathematical calculations. J. Y., notwithstanding his kind offer to instruct his opponent, left the question where he found it, without elucidating it in the slightest degree. It is not, therefore, very wonderful if S. Y. should feel some degree of confidence in his calculations, and the conclusions to which they ultimately led him. At page 69, vol. viii., S. Y. says, "As to railways, I conceive I have proved to those who have taken the trouble of going over the calculations, that a carriage moving ten miles an hour requires the expenditure of ten times the power, per mile, that the same carriage moving one mile in an hour will require; the resistance of the air excluded in both cases; which is all I attempted or intended. Now, it has been publicly asserted since, that the Scotsman never meant to contradict this; but only to prove that the same carriage could be moved over the same space, at the same expense of power, let the velocity be what it would; the resistance of the air excluded as before." Now, sir, if this has been asserted by any public lecturer, or any public writer (for I suppose he means some such public character), I have no hesitation in affirming that the asserter was utterly ignorant of the subject: for the Scotsman does not only mean to say, but does say, and that in very plain language, that with the same expenditure of power per second, we may obtain any degree of velocity whatever, abstracting the resistance of the air; and this is what I will endeavour to prove. But, before I proceed to that part of my subject, allow me to state to S. Y., that I have gone over his calculations, and that I find them founded on wrong principles. At page 358, vol. iii., he gives us a calculation for the first three seconds that the carriage is in motion: in this calculation he assumes that the body multiplied into the difference of the spaces passed over by the carriage, and the body falling freely in space, is a correct measure of the power expended. Now, sir, all writers on mechanics consider the velocity acquired by bodies (not the space passed over) as the measure of their force. Consequently, the difference of their velocity will be a measure of the power expended; or, when the intensity of the force of any body in motion is to be compared with some other force, we multiply the body into the velocity. Hence, if any impulsive force generate in a body any determinate velocity, we assume that a double force will generate a double velocity; and so on of any other number of forces; the body being supposed the same, and under the same circumstances, the velocity will be as the force impressed: therefore, if we denote any impulsive force by f, the body on which it acts by b, and the generated velocity by v, we have from the above $\frac{f}{b} = v$, or $f = bv$. By mechanics, all the relations of time, space, and velocity, are expressed or involved in the equations $S = \frac{1}{2}tv = mt^2 = \frac{v^2}{4m}$, where $S =$ the space, $t =$ time, $v =$ velocity, and $m = 16\frac{1}{12}$ feet; being the space described by a heavy body falling freely near the surface of the earth in the first second of its de-

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she must break her head on the ceiling." He ended by advising the Emperor "to go and paint his flowers." Soon after he was missing; and was supposed to have been killed by order of the Emperor, in revenge for his sincerity.

scent: but, in the case of a carriage on a railway, and a weight hanging over a pulley at the end of a plane, the above equations will not apply, at least without some modification: therefore, if we call the force of gravity 1, and any other accelerating force P, we shall have $1 : P :: m : Pm =$ the space passed over by the carriage in the first second by the accelerating force P. Now, if we substitute Pm instead of m in the above equations, we shall have $S = \frac{1}{2} tv = Pmt^2 = \frac{v^2}{4Pm}$. Now, then, let us suppose our carriage placed on a smooth and level railroad, and let the friction be equal to 90 (b) pounds as before; and let us suppose a weight (a) to be suspended over a pulley connected to the carriage by a line; to determine the circumstances of time, space, and velocity, generated by the action of the descending weight or power P. It is evident, that if the weight and the friction of the carriage are equal, no motion will ensue; but if the weight exceeds the friction by any quantity, however small, motion will ensue; and the force of such motion will be expressed by the excess of the weight over the friction; and the sum of the friction and weight will be the mass moved: therefore our motive force will be $a - b$, and the accelerating force $\frac{a-b}{a+b}$, or $P = \frac{a-b}{a+b}$. We may give a and b any value we please; and P will also be determined. If $a = 102$ and $b = 90$, then $P = \frac{102 - 90}{102 + 90} = \frac{12}{192} = \frac{1}{16}$. Therefore $\frac{1}{16} m$ will be the space passed over by the carriage and descending weight in the first second; and $\frac{1}{16} mt^2$ the space due to any other time, t; and the velocity at the end of any time will be expressed by $\frac{1}{8} mt$. Hence it is obvious that the carriage, with the weight suspended over a pulley, obeys the same law as a falling body. S. Y. admits this (at page 358, vol. iii.), but he denies that this law operates with equal force in equal times: I shall, therefore, proceed to demonstrate that the law of falling bodies also governs the motion of the carriage on the railroad; and that the force with which it acts is equal in equal times. Let us suppose that the velocity of a body, or the body multiplied into the velocity, is a correct measure of its force: let us also suppose that a heavy body falls from rest 16 feet in the first second of its descent: then the following tables will show every thing connected with the motion of falling bodies; and also of the carriage on the railroad for the first five seconds:—

Time in Seconds.	Space in Feet.	Velocity in Feet.	Momentum or Force, divided by the Time in Pounds.	Time in Seconds.	Space in Feet.	Velocity in Feet.	Momentum or Force, divided by the Time in Pounds.	Difference.
1	16	32	$\frac{102 \times 32}{1} = 3264$	1	1	2	$\frac{192 \times 2}{1} = 384$	2880
2	64	64	$\frac{102 \times 64}{2} = 3264$	2	4	4	$\frac{192 \times 4}{2} = 384$	2880
3	144	96	$\frac{102 \times 96}{3} = 3264$	3	9	6	$\frac{192 \times 6}{3} = 384$	2880
4	256	128	$\frac{102 \times 128}{4} = 3264$	4	16	8	$\frac{192 \times 8}{4} = 384$	2880
5	400	160	$\frac{102 \times 160}{5} = 3264$	5	25	10	$\frac{192 \times 10}{5} = 384$	2880

The first three columns of the first table, on the left, show the time, space, and velocity, of falling bodies for the first five seconds. In the fourth column we have the falling body multiplied into the velocity, and divided by the time; which gives 3264 as a constant force. In the second table, we have in the first three columns the time, space, and velocity, of the carriage and descending weight for the first five seconds. In column fourth, we have the mass or body moved, multiplied into the velocity, and divided by the time: here we have 384 as a constant force, which is the power expended upon the carriage per second over and above that expended upon friction, and is equal to the momentum which our motive force (12 pounds) would acquire by falling from rest in the first second. Now, the difference of the above two constant numbers will be the expenditure upon friction; that is, the difference of 3264 and $384 = 2880$: this we have in the right hand column, marked difference. Now $2880 = 32 \times 90 =$ the velocity acquired by a falling body in the first second multiplied into the weight which would balance the friction of the carriage. Hence we see that the whole expenditure of power upon the carriage, per second, is neither more nor less, than that of the moving force (120 pounds) multiplied into the velocity which it would acquire by falling in the first second of its descent. The same constant force, continued for $58\frac{2}{3}$ seconds, will accelerate the motion of the carriage to the rate of twenty miles an hour; by which time it will have travelled $3403\frac{1}{9}$ feet. I say nothing here of the resistance of the air, that being sufficiently explained in the original essay from the Scotsman, in the third volume, of the Mechanics' Magazine. And here I cannot but admire the penetration of that writer, in foreseeing the opposition of practical men; for in a short time they seemed to be all in arms against the new doctrine. I purposely abstain from saying any thing about the mode of giving effect to the above law: having, as I conceive, removed the stumbling-block alluded to by James Yule, in the third volume, I doubt not but that many of your correspondents will point out plans, some of which will answer the end. In conclusion, allow me to offer a remark or two on the comparative merits of canals' and railroads. First, then, the author of the original essay rated the resistance of water much too low, he having only considered the resistance as the square of the velocity. Now, Dr. Hutton found the resistance to be a function of the first and second powers; which appears to agree with the Table by Mr. Tredgold, given at page 431, vol. iv. of the Mechanics' Magazine: consequently the value of railroads, as compared with canals, is rated too low nearly by one half.

I remain, Sir,
Your obedient Servant,
A. MACKINNON.

Sheffield, September 1, 1827.

WORKING STEAM TWICE.

That there is a very considerable gain of effective power obtained by first working steam at a high pressure, and again at a low pressure, must, I conceive, be sufficiently evident to any person who will give the subject a few moments' consideration. I will endeavour, in as concise a manner as possible, to give an illustration of the fact. Suppose the relative areas of the two cylinders to be as 1 to 4, and that the steam, on leaving the lesser cylinder, expands to four times its original volume, its elasticity is of course reduced to one-fourth; now, were it only worked once, no matter whether at high or low pressure, we may call its effect $= 4$. Let us now see the effect produced, if worked twice: it first acts in the high pressure cylinder with a force equal to 4; on being admitted into the low pressure cylinder, it also acts wih a force $= 4$; this being added to the former effect, would give a power $= 8$: but from this must be deducted

the value of the reaction on the smaller piston, which, as the areas and elasticity inversely are :: 1 : 4, will in the present case be $=1$;* therefore the aggregate power of the two cylinders will be 8 less $1=7$, being a profit of $\frac{3}{4}$ of the entire power to be obtained by using the steam once only, whether at high or low pressure; and, generally, the more the steam is allowed to expand, the greater will be the advantage, which will always be equal to the original power, less by a fraction, whose denominator will be the number of times the steam expands, and whose numerator will be 1; for instance, if the steam expands six times, the original force being called x, the profit of power will be $x-\frac{x}{6}=\frac{5x}{6}$, or, $\frac{5}{6}$ of the whole. In this estimation, of course, no allowance is made for additional friction, or any other cause of loss of power. So much for working steam twice.

Let us now compare this with the advantage derived from working steam expansively; assuming, as before, that the steam be allowed to expand four times its original volume, by being cut off at one-fourth of the stroke; and that, if worked of equal density throughout the entire stroke, its effect would be $=4$.

1·3862943, hyperbolic logarithm of number of times to which the steam is expanded; to which
add 1·

2·3862943
× by 4, the force of the steam;

9·5451772 ÷ by number of times to which the steam is expanded (4)

2·3862943
gives 2·3 as an equivalent for the force obtained from one-fourth of the quantity of steam which would have afforded a power $=4$.

This equivalent must of course be multiplied by 4, to obtain the total effect, $2.3\times4=9.2$; while the same quantity of steam, if worked twice, would be equal to 7; and if worked but once, of equal density throughout, it would only $=4$.

Steam worked once, of equal density . . . . $=4$
Worked twice, expanding to 4 times . . . . $=7$
Worked expansively . . $=9·2$
On Wolf's principle, a profit of 75 per cent.; and on Watt's, of 130 per cent.

And this greater advantage is obtained, without the complicated and expensive apparatus requisite on Wolf's principle.

B.

REFRACTIVE POWER OF GASES.

The following Table of the Refractive Power of Gases at the same temperature, and under the same pressure, taking that of air as unity, is highly interesting, and is extracted from a paper on this subject by M. Dulong.*

	Refractive Power.	*Density.*
Air	1	1
Oxygen	0·924	1·1026
Hydrogen	0·470	0·0685
Azote	1·020	0·976
Chlorine	2·623	2·470
Oxide of azote	1·710	1·527

* The deduction for the reaction on the small piston should be considerably more than 1, as the steam is not at liberty at once to expand—it is a gradually decreasing resistance from 4, the assumed maximum force, to 1, the minimum; in point of fact, therefore, it exceeds 2, probably amounts to nearly 2 and a half: it of course follows, that the real gain by working steam twice does not exceed half of the original power.

* Inserted in the "Annales de Chimie," xxxi. 154.

Nitrous gas	1·030	1·039
Muriatic acid	1·527	1·254
Oxide of carbon	1·157	0·972
Carbonic acid	1·526	1·524
Cyanogen	2·832	1·818
Olefiant gas	2·302	0·980
Gas from stagnant water, (carburetted hydrogen)	1·504	0·559
Muriatic ether	3·720	2·234
Hydrocyanic acid	1·531	0·944
Ammonia	1·309	0·591
Phosgene gas	3·936	3·442
Sulphuretted hydrogen	2·187	1·178
Sulphurous acid	2·260	2·247
Sulphuric ether	5·197	2·580
Sulphuret of carbon	5·110	2·644
Proto-phosphuretted hydrogen	2·682	1·256

The vapours of muriatic ether, sulphuric ether, and sulphuret of carbon, were taken at a degree of density two or three times less than that corresponding to the maximum relative to each observation: the numbers contained in the preceding Table are therefore comparable with those of permanent gases. In taking these same vapours at their maximum of density, their refractive powers are found to be as follows:—

Muriatic ether	3·870
Sulphuret of carbon	5·198
Sulphuric ether	5·290

Conclusions.—It results from M. Dulong's researches, that the capacities for heat, and their refractive powers, do not belong, as has been supposed, to the same order of causes. The capacities have an evident relation to the masses of the molecules; the refractive powers appear to be independent of them.

No simple ratio exists between the refractive powers of elementary and of compound substances, even when these properties are observed in circumstances where the molecular action can be most readily compared, and where the form and arrangement of the particles cannot exert any influence.

The variations in the velocities of light passing through the different gases considered at the same temperature and pressure, appears to depend upon the peculiar electric state of the molecules of each kind of matter. Reasoning on the theory of undulations, which seems to accord best with these new ideas, the velocity of light is more powerfully diminished, according as the molecules are more strongly positive.

D.

HINTS FOR IMPROVEMENT OF STEAM VESSELS.

Sir,—If you think the following notes, in reference to improvements in steam vessels, worthy of notice, you will oblige a constant reader by their insertion.

1. Observe minutely the forms of fish and marine animals of large bulk, and by what means nature has furnished them with mechanical powers for cutting their way in the sea.

2. Take for example the whale, or the porpoise, which are both bulky in front and taper behind.

3. Their propelling fins are more forward than backward; and below rather than above their middle.

4. Again, their motions are apparently rapid and easy, displacing the water without much resistance.

5. Apply these remarks to steam vessels, and it would tend to the alteration both of their structure, and the place and nature of the machinery.

6. We should have a large front curved perfectly smooth, an immediate diminution towards the centre, and a narrow stern.

7. Again, the paddles, instead of being at each side, would be at or near the bottom in front; in the centre, also, (probably); operating in this way like the tail of the fish.

8. Then, again, they would never miss the stroke—the motion, consequently, would be more equal and uniform.

9. The strength, also, of the steam would be better supplied; added to which, the perfectly smooth circular front would more readily clear its

way through the water, and avoid all jerking.

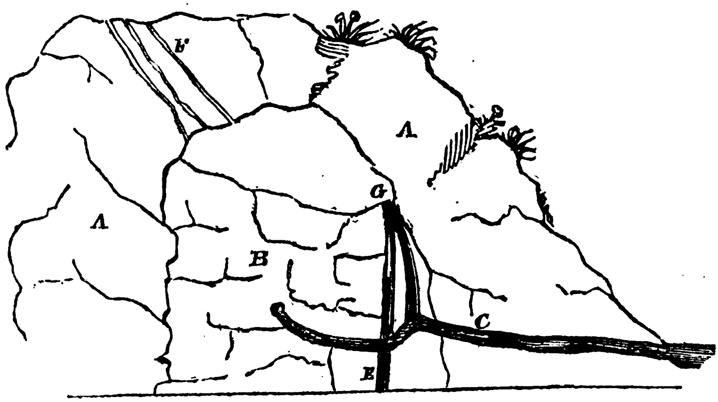
10. The Dutch improvement (see Mech. Mag. p. 168, vol. viii.), of removing the paddles to the stern, seems to be highly advantageous. How much more so with the addition of front movements, where the power is evidently more effective!

11. I believe that the alteration of the form of the vessel, as before suggested, would of itself be a palpable improvement, as every thing tending to keep up regular propulsion is advantageous.

Yours, &c.
A. B.

Oct. 2, 1827.

GIGGLESWICK EBBING AND FLOWING WELL.



Sir,—Your correspondent J. M. N., in the 6th vol. of the Mechanics' Magazine, p. 408, having given a description of the intermitting spring, with your permission I will solicit the attention of your readers to a description of the ebbing and flowing, or reciprocating well; for it will be seen that these two springs are essentially different both as to their cause and effect.

The intermitting spring, as the word implies, runs and ceases to run alternately; yet it will be found to be as regular in the delivery of a certain quantity of water, in a given time, as any other spring: but it is not so with Giggleswick ebbing and flowing well. Though it never ceases to run, yet it is extremely irregular, both as it respects the time and quantity of its ebb and flow. You may sometimes stand by it for hours together, without perceiving the least variation; whilst at other times it will be up and down in the trough, two or three times in a minute. Indeed, nothing can be more whimsical or capricious in its effects.

The only rational or plausible theory of these curious productions of nature, that has fallen under my observation, is that by Mr. Gough, published in the Manchester Philosophical Transactions. But the explanation there given, though extremely ingenious and acute, is too complicated and delicate for a permanent natural phenomenon, as it chiefly rests upon the casual formation of air bubbles in the lowest part of an inverted natural syphon. Nature is very economical in her means, and is known to produce wonderful effects from very simple causes. Frequent and attentive observation has convinced me, that the Giggleswick well varies the least in still, settled weather, and that its ebb and flow are quickest, and the stream most copious, when

the weather is wet and boisterous. I will, therefore, endeavour to show that springs of this kind are under the influence of the wind, and, in a great measure, subservient to its variations.

A A is the section of a hill; B is a cistern full of water, having a hole in its side, through which the water issues and runs in the channel C down to the well. This hole not being of sufficient capacity to discharge the water as it flows into the cistern, it continues to run over at its lowest part. While the surface of the water in the cistern remains undisturbed, it falls perpendicularly, and runs off in a distinct channel, E. But in the side of the hill there are a number of fissures, as at F, through which there is a communication betwixt the external air and the surface of the water in the cistern. When the wind is high, it penetrates through the fissures, and inflates the water as it passes over the spout G, and causes it to reach over into the channel C; and thus occasions the ebb and flow in the well.

Hence it is apparent that its singular variations are subject to the action of the wind, and may be said to be as fickle as that ungovernable element.

A few ages ago, our ancestors were puzzled in accounting for the irregularities of this spring; and the jolly poetical itinerant, known by the name of "Drunken Barnaby," thus describes it in his "Tour to the North:"

"Near to the way, as the traveller goes,
A fine fresh spring both ebbs and flows;
Neither know the learned that travel,
What procures it, salt or gravel."

ATHELSTAN.

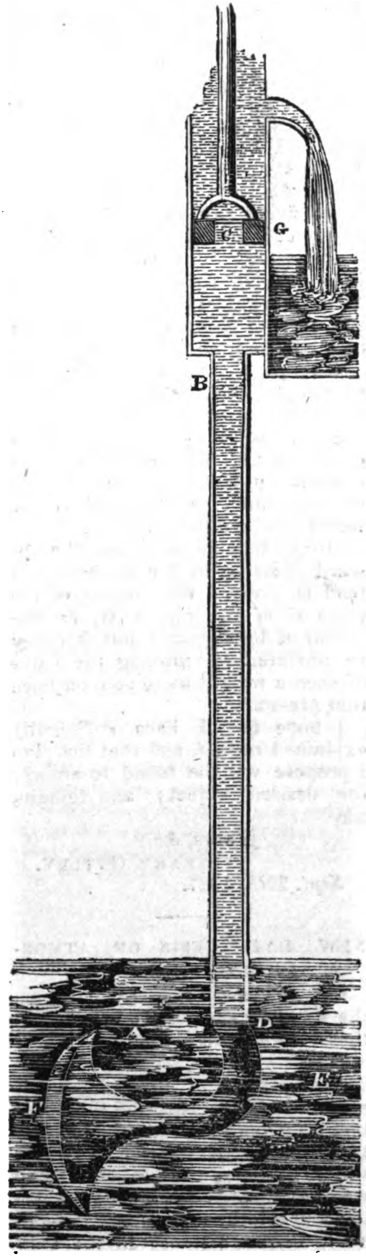
Keighley, Aug. 1827.

ANSWER TO THE QUESTION ON PUMPS.

(P. 169, vol. viii.)

Sir,—In your Magazine, No. 214, there is an inquiryrespecting pumps, to which I shall reply as concisely as possible.

I think there can be no doubt but that the current being under



the mouth D of the pipe B D, must

tend to increase the labour necessary in raising the water up the said pipe. For, before any water can be drawn up, the current of the exterior water must be stopped on bringing it through the opening D; it is evident this inconvenience would not be sustained were the water A E stagnant. I should think, therefore, that if the proposed well were carried sufficiently deep to prevent there being any commotion in the water contained, it would be advantageous. But as this would incur a great expense, I shall now propose what I think would answer the purpose quite as well, and be at the same time much cheaper.

I propose that the end of the pipe B D should be turned up as at F, with the opening F *towards* the current of the water. It is evident that then, so far from the current preventing the water's entering the pipe, it would rather tend to assist it in its ascent.

It may be objected, that the upward pressure of the water would tend to prevent the closing of the valve C of the piston G, on the *ascent* of that piston; but this may be obviated by making the valve of such a weight as to counterpoise that pressure.

I hope that I have sufficiently explained myself, and that the plan I propose will be found to answer the desired object; and remain, Sir,

Yours, &c.
HENRY OTTLEY.
Sept. 29*th*, 1827.

NEW HYPOTHESIS OF ATMOSPHERIC PRESSURE.

Sir,—I have often reflected on the seeming absurdity of the hypothesis laid down, and generally received, as to the difference in the specific gravity of atmospheric air according to the state of the weather; I mean the established notion that the air is heavier in warm sultry weather, than in cold rainy weather. This hypothesis seems to be upheld by the influence of the air upon the mercury in the bulb of a barometer; but it is certainly at variance with every principle of sound philosophy, to suppose that any material substance, in its dilated or expanded state, can be specifically heavier than in its condensed or contracted state; and as it is well known, that heat dilates all material bodies, and rarifies air to an astonishing degree, almost infinitely, it must therefore follow that the specific gravity of air is much less during the dry heat of summer, than in the cold rainy winter months. The contrary notion has, however, generally obtained; and is apparently sanctioned, as I before observed, by the visible effect of the pressure of the external air in dry hot weather, upon the mercury in the bulb of a barometer; thereby causing it to ascend in the tube, and the contrary in cold moist weather—this must be admitted as an indisputable fact, and is, I believe, almost universally so: but this pressure does not proceed from the specific gravity of the atmosphere; for, in fact, when the specific gravity of air is least, its pressure upon the external surface of all bodies is greatest—and this seeming contradiction is easily reconciled, when we consider that the more any quantity of air is rarified, the more space it will occupy; or, if confined, the more space it will tend to occupy and encroach on other matter, and consequently the greater will the pressure be on all surrounding objects; and as this tendency to occupy a greater space operates in all directions, both upwards and downwards, latitudinally and longitudinally, it cannot be termed its specific gravity, as that is construed only into a tendency towards the earth's centre, which will always be the greatest in a given quantity of air in its most condensed state. This view of the subject will account for the greatest rise of the mercury in the tube of a barometer when the air is actually at its least specific gravity, without militating against the established rules of natural philosophy in regard to rarefaction and condensation.

It might be objected to by some, on the supposition that there is no

limitations to our atmosphere; but this objection can have no weight with any scientific mind; for as space or vacuum cannot exist in nature (although produced artificially), our atmosphere must be bounded by some fluid body, which is no doubt capable of repelling any very considerable intrusion, yet perhaps does admit of our atmosphere extending its limits to a certain degree, when in a very high state of rarefaction. This doctrine is perfectly consistent with, and confirmed by, the indication of the barometer in the various states of the weather, as I intend, with your leave, through the medium of your Magazine, to explain at a future opportunity; and to consider upon what natural principles the clouds, which are composed of particles of matter specifically heavier than air, are supported in a state of buoyancy by that element.

J. S.

ON A NEW CONSTRUCTION FOR A BOAT.

Sir,—Business and absence from town, I hope, will excuse me with G. B. for not taking sooner notice of his last, in No. 207, p. 59.

In my reply to G. B., my wish was to invite a fair consideration of the merits of the proposed new construction of a boat; but G. B., in his last letter referred to, appears only disposed to persist in the idea of the plan being a plagiarism on the Flying Proa. Having, Mr. Editor, from the first, acknowledged that the idea of a lee-sided boat may have originated from that mode of construction, I have nothing further to say on this head, but that I admit nothing beyond this.

As to the plan being substantially the same with the Flying Proa, as G. B. asserts, had not a portion of my letter of 5th May, 1827, in page 293, vol. vii. been omitted, the distinction between the Flying Proa and my plan would have been better seen, by the contrast drawn by me of the correspondence of the plan, as stated by G. B., and the difference stated by me. I do not complain of the omission, Mr. Editor; on the contrary, I feel much obliged by the admission of my plan into your pages: but I think what was omitted would have made more clear to G. B.'s conception the real and essential distinction between the plan proposed and the Flying Proa.

G. B.'s introduction of Mausoolah boats, and his reasons for the construction of the Flying Proa in the fashion it is constructed, I will leave for the consideration of others; with this protest only on my part, that, if I understand G. B.'s exposition, I entirely differ from him in the notions he entertains on that subject. On his mention of Gravesend boats and frigates, I will only observe, that there is the same distinction of construction between my plan and the Flying Proa, as there is between a Gravesend boat, or any complete sailing vessel, and the Flying Proa, or any vessel of similar construction, with a frame-work or outrigger; my boat differing from a Gravesend boat, in being constructed to sail on one side only with advantage.

My plan is not a canoe, or vessel that can only swim and sail with the aid of a frame attached, or a double boat; but is a complete built vessel of itself, constructed to sail on one side, for the sake of advantages to be gained in point of fast sailing (resulting from such mode of construction) on the principles or reasons I have before assigned. The essential points I will beg leave to repeat here, are, that of giving more extreme bearing on the side, to obtain the greater effect or lever of the ballast, and at the same time to present less opposing surface to the passing through the water. To appreciate these points, it should be observed, that equal-sided vessels have their greatest proportion of bearing along the middle portion of their length: the plan proposed differs from that, by having the greatest bearing on the lee side, thereby acquiring greater lever on the other side, and effect from the ballast; while the greatest bearing thus acquired, being in a longitudinal direction, will offer less resistance in the passage through the water.

But I beg pardon, Mr. Editor, for occupying your columns with the vindication of the *novelty* of my plan; which really I do not so much care for, as the benefit that may be produced by it; unless, indeed, the fact of its being clearly shown to be a construction which has not been previously detailed to the world, or tried, may induce those whose interest and business it is to consider the construction of vessels, to see sufficient merit in it to give it a trial.

But not to waste more of your columns,

Mr. Editor, or the reader's time, I will close the subject with observing, that I am sorry my address has been lost by you, so that you could not supply it to G. B. I now leave it with you, and shall be happy to exhibit the model to G. B. any time he will fix; and by giving me a day's previous notice, I will endeavour to be at home; at all events, the model shall be left out for his inspection. I apprehend I am mistaken in supposing I knew G. B. From some particulars mentioned by him, I think he cannot be the individual whom I supposed I knew: I shall, nevertheless, be happy in showing him every attention in my power.

Yours, &c.
A. B. W.

Sept. 27, 1827.

*** Erratum in No. 194, page 293, 2d column, line 18 from top, for "*boat* A *canoe*," read "*boat* OR *canoe*."

RECANTATION OF G. S.

Sir,—Mr. Henry Ottley, in his last communication, feels rather sore that I have taken the field against him. I must confess, in this I have rather taken a cowardly part, as he (Mr. H. O.) had two to one to contend with before I entered the list against him. Nay, more, sir, after reading and duly pondering over his last three communications (see pages 186, 187, 188, vol. viii.), I find myself compelled to be a convert to his new systems of algebra, geometry, and natural philosophy. As a small reward, however, for his very important discoveries, I am happy to state that it is in my power to dub him *Commander-in-chief of the New Light System*; and, as an atonement for my temerity in daring to oppose his new system, I shall only appoint myself to the humble situation of chief trumpeter of the followers of the New Light. At the same time, let it be understood that all those who will pertinaciously adhere to the dogmas of the old school are to be denominated *Believers of the Old Light*; or, perhaps, it might be better to name the former *White Sheep*, and the latter *Black Sheep*. Having premised this much, I shall now proceed to point out some advantages which the *White Sheep system* has over that of the *Black Sheep*.

Mr. Shires' formula for finding the height of a balloon is $h = \frac{571}{16}(\sqrt{571 + 32m} - 23{\cdot}9)$* (page 172, No. 214). Mr. Henry Ottley's general equation (No. 215) is $xt^2 = h$. Now, you black-fleeced sages of the Old Light system, pray observe the simplicity of Mr. Ottley's New Light equation. True, he does not inform us what the value of x is, and h is to be found. Nothing, therefore, but a knowledge of the New Light can inform us what the value of h is. Nor does Mr. Henry Ottley fetter his general equation with any considerations of the resistance of the air increasing with the velocity of the ball; from which we (of the New Light) must infer, that the resistance of the air on the ball will be precisely the same, whatever the velocity may be. (Shades of Galileo, Newton, Robins, Hutton, &c. hear the dictum of Mr. Henry Ottley!) Neither does Mr. H. O—y burden his general New Light equation with any consideration about the time sound will be in moving from the surface of the earth to the balloon: it therefore follows, from the New Light system, that sound must be instantaneous; from which the following important deduction is apparent:—

Corollary.—Since sound is instantaneous, and it is well known that light moves with a greater velocity than sound, hence light will pass from one point to another in *less than no time!!!*

My remarks on the next two articles of Mr. Henry Ottley I must postpone for a future Number. In the mean time, I am, Mr. Editor,

Yours with respect,
G. S.

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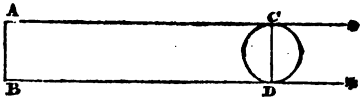
* If Mr. S. could bring the balloon to an anchor during the time of making the experiment, and if the height did not exceed one mile, his formula would give a near approximation to the height; but when the height is great, his formula cannot be depended on. See page 208, vol. ii., *Hutton's Course on Practical Gunnery*.

DIRECTIONS FOR MEASURING THE DIAMETER OF A ROUND STEEPLE, &c.

BY WM. SHIRES, MATHEMATICAL TUTOR.



Let C D be the diameter sought; and let two observers, the one at A and the other at B, stand so as to see a star just appearing to touch its opposite sides, C and D; the direction of the one spectator from the other being at right angles to their direction from the respective sides of the steeple, the distance betwixt the spectators is the measure C D, *i. e.* the diameter of the steeple.

Note.—From the extreme distance of a fixed star, all rays from it to every part of the earth arise in parallel lines.

STOCKINGS.

"Come and foot it, as ye go."
MILTON.

Sir,—In Wales, it is quite usual to see women, even with loads for market or elsewhere, knitting stockings as they go, footing it along industriously and nimbly; feet and hands alike in motion: but though they "foot it" well on their pins on the road, I am not aware whether they can, by the needles, "foot" a stocking. I am in the same uninformed state as to the capabilities of stocking looms or frames, for I know not which they are called; but this I know, that if they do possess a facility to perform so useful a work, it is a pity that it is not more generally known, for there would assuredly be much employment for them. It is grievous to possess stockings of good price, unimpaired in the legs, but "quite gone" at the feet: and what is to be done with them?—to throw them away one is loth; and, as to mending—heigh ho! heigh ho! as Vestris sings. Now, I think, that "Mechanics" as a science, and "Mechanics" as stocking-wearers, are alike concerned in this inquiry—Whether (if the facilities do not already exist) a mode of manufacturing might not be adopted, by which the thread may be fastened off, to prevent unravelling all round the heel and along the quartering of the shoe; some high, some low, according to the fashion of the wearers, and suitable for winter and summer; so as to admit of the foot (of the stocking, mind ye) being cut off when worn out, and replaced by a new one, made in the shape of fleecy-hosiery socks, which every body must have seen? Thus, one might be encouraged to buy (for summer) the *finest* hose, as they could be adapted to a stronger kind of socks, which would be an article of separate sale. Surely, as to boot hose, there can be no difficulty in introducing some such contrivance; which would be of service to the stocking weavers and hosiers, in repudiating what are termed "short stockings," but which are, in truth, no stockings at all.

I am, &c.
W. D. PEDE.

COLOURS OF FLOWERS.

It is not generally known, although long ago noticed by M. De Candolle, that, among flowers, yellows will not produce blues, nor blues yellows, although both these primitive colours will sport into almost every other hue. Thus the hyacinth, the natural colour of which is blue, will not produce a yellow; for the dull half-green flowers, called yellow hyacinths, are in truth but whites approaching to green; the blue crocus will not vary into yellow, nor the yellow into blue; and the ranunculus and the dahlia, the natural colour of both which (notwithstanding the popular belief to the contrary, as regards the latter) is yellow, have not yet been seen to exhibit any disposition to become blue, although they are the most sportive of all flowers—varying from yellow to pink, scarlet, and the deepest purple.

ROOF OF THE THEATRE OF THE LONDON MECHANICS' INSTITUTION.

Sir,—Having been a subscriber to, and constant reader of, your valuable work, "The Mechanics' Magazine," from its first Number, I am of course acquainted with its contents, and beg to thank you for the favourable opinion you are pleased to express of my endeavours to familiarize the truths of science in the Lectures I have given to the members of the London Mechanics' Institution.

You assert, correctly, that I had no hand in the building of the theatre. I purposely abstained from all interference, from a feeling that the gentlemen placed upon the Building Committee were fully competent to the task, and that interference might have been deemed impertinent. You are, however, under an error in stating that the roof of the Theatre is now undergoing a thorough repair under my management. The fact is, I am only one of a committee of six gentlemen,* appointed by the general Committee of Management, to carry these repairs into effect. I had personally examined the state of the roof before the repairs were begun, and convinced myself of their necessity; and I also fully approve of what is now doing, and nearly accomplished, for the future security of the roof: but in these investigations and repairs I have merely acted in conjunction with my brother committee-men; and shall therefore feel obliged by your correction of the statement made in this day's Magazine, that such repairs are doing under my sole direction. By so doing, you will oblige, Sir,

Your very faithful Friend,
JOHN MILLINGTON.

36, *Bloomsbury Square,*
Saturday, October 13,
1827.

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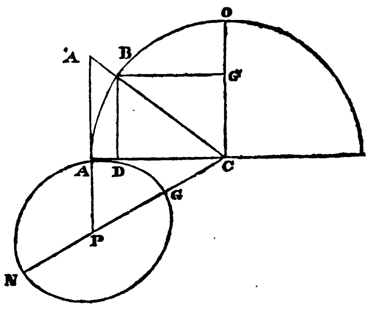
* Mr. Toplis, Mr. Topple, Mr. Holdup, Mr. Johnson, myself, and Mr. M'William.

GEOMETRICAL SOLUTIONS OF THE PROBLEM PROPOSED IN No. 194, p. 296.

In No. 210 we gave an *algebraic* solution of this problem, by our French correspondent, F.; and expressed at the same time an opinion, that constructions obtained in this method are generally less elegant than those derived from pure geometry. We have since received from the same gentleman the two following solutions, in which it will be seen he has ably combined the excellencies of both methods. The originals are in French; but, for the sake of brevity, and the benefit of such of our readers as may not be familiar with that language, we insert translations of them merely.

First Solution.



Supposing the problem resolved, we have,

1st. $DC : BD = AC : AA'$, or DC; then, $\overline{DC}^2 = AC \times BD$.

2d. $\overline{DC}^2 = \overline{BC}^2 - \overline{BD}^2$; consequently,

$$AC \times BD = \overline{BC}^2 - \overline{BD}^2,$$

or $(AC + BD)\, BD = \overline{BC}^2 = \overline{AC}^2$.

Making the perpendicular $AP = \frac{1}{2} AC$; and drawing a circle with the radius AP, we have $NG = AC$; and AC being the tangent, $\overline{AC}^2 = NC \times GC = (AC + GC)\, GC$: then $(AC+GC)GC = (AC+BD)BD$, being the identical equation in which $GC = BD$.

And afterwards, *for the construction*, draw the perpendicular OC; and from the point G', draw $G'B$

parallel to A'C; we have then the point B, which determines the arc demanded.

Second Solution.

Preserving the same denominations as the first solution, we have the two equations,

$$y^2 = a\,x,$$
$$x^2 + y^2 = a^2;$$

the first of which is the equation of the parabola, and the second the equation of the circle; which shows that the parabola, the perimeter of which is a, will cut the circle, the radius of which is a, in a point which will determine the arc required. The point C being taken for the summit of the parabola, and the straight line O C being the axis of x, the parabola is easy to construct.

I am, Sir,
Your's respectfully,
F.

A MODE OF PRESERVING WOOD IN DAMP SITUATIONS.

Sir,—Two coats of the following preparation are to be applied; this being done, the wood is subject to no deterioration whatever from humidity. Twelve pounds of *resin* must be beaten in a mortar, to which add three pounds of *sulphur* and twelve pints of *whale oil.* This mixture must then be melted over a fire, and stirred during the operation. *Ochre* reduced to an impalpable powder by triturating it with *oil,* must then be combined in the proportion necessary to give either a darker or a lighter colour to the material. The first coat must be put on very lightly, having been previously heated; the second coat may be laid on in two or three days afterwards; and a third, after an equal interval, if from a peculiar dampness it be required.

I am, Sir,
Your obedient Servant,
JAMES COX.

Nursery-place, Hackney, Sept. 1, 1827.

A PASTE FROM HORSE CHESTNUTS.

The chestnuts must be peeled, and dried over a slow fire, and ground to a fine powder. This powder, being mixed with a third of flour, will make an excellent paste for the use of bookbinders, shoemakers, printers, &c.; better than that which is made from flour only.

J. COX.

Nursery-place, Hackney, Aug. 26, 1827.

ASTRONOMICAL QUERIES.

Sir,—Should the following solution of his "Astronomical Query" be of any use to "Rus Astro" (No. 214, p. 175), it is at his service.

He says, that "in converting time into arcs, it is usual to allow 15° for one hour in time, whether that time be given in *mean solar,* or *sidereal time.*" This statement is incorrect: the 15° are allowed for one hour MEAN SOLAR time; so, at least, the author of every work which I have perused on this subject says; so I have always considered it. Hence, in the case to which "Rus Astro" alludes, the longitude of the second meridian is 113° 2′ 30″ E. the quantity resulting from calculation made on the supposition of the time being mean solar. Hence, also, in the tables of latitude and longitude, the time in which the latter is given is always mean solar. Hoping these remarks will satisfy "Rus Astro," on the point under consideration, I remain,

Yours and his truly,

$$H\sqrt{\left(a^2 \frac{a^2}{2}\right)}H.$$

Carmarthen, Oct. 4, 1827.

P.S. I shall feel obliged by an early answer to the following:—

By what formula to calculate the TRUE obliquity of the ecliptic for any given time, as in White's Ephemeris?

By what rules to form tables for calculating the reduction of the planets to the ecliptic for any given longitude in their orbits?

SECOND ANSWER TO THE ASTRONOMICAL QUERY.

(*Vide Vol. VIII. page* 175.)

Sir,—Your correspondent, "Rus Astro," labours under a mistake, as to converting *sidereal* time, into longitude.

It is distinctly stated in the Nautical Almanac, that the eclipses of Jupiter's satellites are computed for *mean* time (*i. e.* mean solar time): they were a few years since computed for *apparent* time; but as good chronometers denote mean time, it was thought preferable to give the eclipses of Jupiter's satellites in mean time also.

On account of the annual motion of the earth round the sun, the stars make 366 diurnal revolutions in 365 solar days, very nearly. Consequently the fixed stars will pass over 360 degrees of longitude on the earth's surface, more than the sun, or a complete circuit of the earth, in one year; and in proportion for any other space of time.*

* A sidereal day is the interval of time elapsed between two successive transits of a star over the meridian, and which is completed when the meridian of the observer has moved through 360°; with respect to the fixed stars, it is less than the mean solar day in the proportion of 360° to 360° 59′ 8·1926078″; and, consequently, expressed in hours, minutes, and seconds, of mean solar time, is equal to 23 h. 56′ 4·09967475″.

The secular motion of the sun in 100 Julian years, according to the best observations, is 45′ 45″ over and above 100 revolutions. The recession of the equinoctial points in the same period is 1° 23′ 30″, being its distance from the same fixed star with which it was in conjunction at the commencement of the century: we must therefore take their difference; viz. 1° 23′ 30″, and +45′ 45″, the first being minus, and the latter plus; their difference is 37′ 45″, which is the distance between the sun and a fixed star, after 36525 consecutive returns of the sun to the meridian; we shall, therefore, have

$$36525 \text{ days} + \frac{23\text{h. } 56' \ 4'' \ 1 \text{ sec.} \times 37' 45''}{360°}:$$

for as 1 revolution, or 360°, is to a sidereal day, or 23 h. 56′ 4·1″; so is 37′ 45″, the distance of the sun and fixed star, to 2′ 30·587721″; therefore that star will not come to the meridian, till after the sun's centre has passed it by 2′ 30·587721″ of mean solar time; in which time, by the diurnal rotation of the earth on its axis, the stars apparently pass over (with respect to the meridian) an arch of 37′ 45″. This arch is measured by the *sidereal* rotation of the stars, *and not by the diurnal motion of the sun, as stated in Dr. Hutton's Mathematical Dict.* (Art. Sidereal Day.) Whence in 36525 days + 2′ 30·587721″ or in 36525 days 0 h. 2′ 30·587721″ the stars make 36625 revolutions or consecutive returns to the meridian; and dividing the former by the latter, we have the sidereal day equal to 23 h. 56′ 4·09967475″—exactly the same as before stated; and multiplying this last result by 366, the number of sidereal days contained in a year, we have 365 days 0 h. 1 min. 0·4800585 sec., the mean solar time corresponding thereto.

Now, in the instance referred to by your correspondent, the difference in *solar* time in which the emersion takes place at Greenwich, and the place of observation, is equal to 7 h. 32 m. 10 sec., and in *sidereal* time equal to 7 h. 33 m. 24·27 sec.; their difference is equal to 1 m. 14·27 sec., which, converted into space, at the rate of 15 degrees to 1 hour, gives 18′ 34″ the difference in longitude; the same as stated by your correspondent (on the supposition that the latter erroneous method is employed, or that of sidereal time instead of solar). It is, therefore, hardly necessary to state that the measure of time in which the longitudes are expressed in the Tables is that of solar time.

ASTRO SOLIS.

6th Oct. 1827.

NOTICES TO CORRESPONDENTS.

C.'s paper is intended for insertion.

Communications received from Junius —T. S.—Mr. Child—H. O.—Ekoorbe —Mr. Bayley—A. B. C. D. E.—Mr. Utting—A Subscriber at Farnham—A Constant Reader—W. D.—Glevum.

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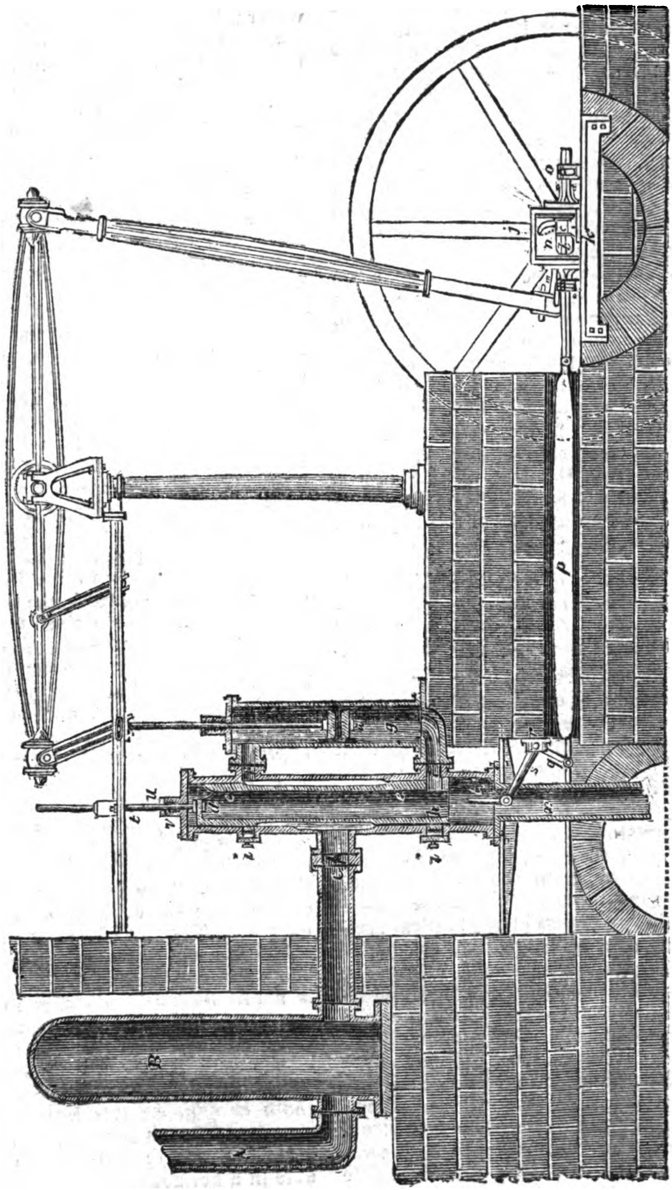
MANWARING'S STATICAL HYDRAULIC ENGINE.



STATICAL HYDRAULIC ENGINE.

BY MR. GEO. MANWARING, ENGINEER.

In the fifth volume of the Transactions of the Society of Arts, there is a description, by the late Mr. Smeaton, of a statical hydraulic engine, invented by Mr. Wm. Westgarth, and rewarded by the Society in 1769. The attention of the Society being particularly directed last Session to the working model of the above engine, placed in their repository, the same was referred to the consideration of a committee. At one of the meetings on this subject, it being stated that Mr. Manwaring had some years ago erected, near Whitby, an improved engine on the principle of Mr. Westgarth's, it was recommended to the Society to make application to Mr. Manwaring to furnish them, at their expense, with a drawing or model of the engine so improved by him. With this request Mr. Manwaring very obligingly complied; and we now extract from the last volume of the Society's Transactions a representation and description of this improved engine.

Description of a Statical Hydraulic Engine, erected by Mr. Manwaring, for Messrs. Cook and Co., at their Alum Works, near Whitby, in the year 1812.

"In the common steam-engine the prime mover is a piston-rod, alternately rising and falling in a cylinder, in consequence of the elasticity of steam let into the cylinder alternately above and below the piston. In the statical hydraulic engine, the prime mover is exactly the same as in the steam-engine; but the motion given to the piston-rod is by means of the statical pressure of a column of water applied alternately above and below the piston. Prefixed is a representation of the engine. A is the pipe by which the supply of water is brought from a head, 170 feet above the engine; B is a vessel containing air, the continual elastic pressure of which prevents the blow that would otherwise be occasioned by the descent of the water; *c* is a throttle valve; *dd* is a hollow open cylinder, working within an exterior one, and closely applied to that cylinder at the parts *e e*, but elsewhere leaving a vacant space between the two cylinders for the reception of the water; *hh* are packings, in order to prevent the escape of the water between the two cylinders; and *ii* are adjusting screws, to tighten the packing in proportion as it is worn away; *ff* are tube passages that lead into the upper and lower ends of the pipe *g*, in which the piston *w* works. When the cylinder *dd* is in the position represented in the plate, the communication is open, by means of the upper pipe *f*, for the water to flow into the pipe *g*, above the piston *w*; at the same time, the passage is open for the water in the cylinder *g*, below the piston, to flow out through the lower pipe *f*, and through the lower part of the open cylinder *d*, into the pipe *x*, which is somewhat more than 30 feet long, and terminates in a cistern of water. There is, therefore, above the piston *w*, a hydrostatic pressure equal to 170 feet of water, and below it a partial vacuum; the piston, consequently, descends to the bottom of the pipe *g*. By the time that it has arrived in this position, the cylinder *d* will also have descended so far as to have opened the communication between the entering water and the lower pipe *f*, and to have shut off its communication with the upper pipe *f*; the hydrostatic pressure is therefore transferred to the under part of the piston, which consequently rises, while the water above the piston pours into the top of the clinder *d*, and escapes through the pipe *x*. The alternate motion of the slide or cylinder *d* is thus effected. The rod of the piston *w* is attached at its top to one end of the beam; at the other end of the beam is a rod terminating below in the crank *m*: the oscillating motion of this crank is transferred, by means of the connecting bar *l*, to the axis *k*, on which is placed the curved tooth or cam *n*: this latter is inclosed within the rectangular frame (or cam-box) *j*; and being moveable in a horizontal position, is con-

sequently made to perform a backward and forward motion, by the cam pressing first on one and then on the other side of the box. To the outside of the box are fixed two guide-bars, supported on the bearings *o o:* the connecting rod *p* is fastened at one end to the guide-bar, and at the other end to the arm *g* of a bent lever, having for its fulcrum the pivot *r:* the other end of the lever is forked, and embraces the pipe *x;* one of these forks *s* is connected with the lower end of the upright rod *t*, and the other fork is connected with a similar rod. These rods are fastened at top to two ends of a cross-bar, to the middle of which is fixed the rod *u*, which works in the stuffing-box *v*, and gives motion to the slide *d*. The slide remains stationary nearly half a stroke of the piston, in order to allow the water to act with its full force; and this is effected by its being necessary for the cam, after it has moved the box in one diretion, to perform about a quarter of a revolution before it can act on the opposite side of the box. The reason for making the passages *ff* as large as represented, is to diminish as much as possible the friction of the water, which otherwise would retain the motion of the piston.

PROJECTILE AND GRAVITATING FORCES.

(*Vol.* ii. *pages* 338, 384, 427; *and Vol.* iii. *pp.* 60 *and* 100.)

Sir,—It is demonstrated by writers on central forces, that a planet must fall through half the radius of its orbit before it acquires a velocity equal to its projectile force: hence it is evident that the projectile and gravitating forces of a planet can never be equal in a circular orbit; it is also equally evident that the gravitating can never exceed the projectile force, it being impossible that the velocity of a planet, at the first moment of its descent, should be equal to the velocity it would acquire in falling half way to the sun. According to the Theory of G. A. S., in the time in which the gravitating force would solicit a body to fall from *a* to *s*)vol. ii. p. 338), it would, by its projectile force, pass in the circle from *a* to *c;* arrived at this point, the forces are equal, *i. e.* the versed sine is equal to the tangent, each being equal to the radius. Now, it would be impossible for the gravitating force to carry a body into the opposite semicircle, without the projectile force carrying the body through the point *c* into the opposite semicircle also, as the line from which both forces are measured is always parallel to *c s:* whence the gravitating can never exceed the projectile force, although the contrary may take place to almost any amount. The ratio of the forces is widely different from that of equality; the projectile force of the earth (for one second of time) exceeds the gravitating force by upwards of ten millions of times; and that of Uranus 844 millions.

G. A. S. *versus* Capt. Forman, (vol. ii. page 427). Your correspondent admits that the gravitating and projectile forces are uniform, and that neither are in their nature accelerated. In the case of Capt. Forman, your correspondent remarks, that the swimmer must exert a quadruple force to overcome a quadruple force; and that both are in their nature projectile forces,* that is, passing over equal spaces in equal times; he then supposes the projectile force of the stream to be at once doubled, and the man, from that time till he reaches the shore, to be continually *accelerating* his speed according to the laws of gravity.

Now, sir, Capt. Forman says nothing at all about the man's accelerating his speed; this is an obtrusion of your correspondent, in which, unfortunately, he commits himself, as he says, just before, that the respective forces are uniform; and there-

* It may with equal propriety be asserted that they are gravitating forces, as it matters not whether the cause is produced by attraction or repulsion; whether the attractive power resides in the sun, or planets, or both, the effect is the same.

fore what he says about the ratio of the forces, supposing the projectile force to be doubled, &c. is all imaginary, and has no existence in the planetary motions.

The remark (vol. ii. page 339) in reference to what Capt. Forman says, was, I considered, very applicable to my question; for admitting the forces in the directions *a b* and *a s* to be equal, the man would, in consequence of the compounded motions, pass in the diagonal line *a c*; and supposing the strength of the stream to be suddenly increased four-fold, the man must evidently exert four times his former force, in order to pass in the same diagonal line; for, in whatever ratio the velocity of the stream is increased, the man's exertion must evidently be increased accordingly, to pass through the stream in the same tract, and in the same time.

I am, however, not going to justify Capt. Forman in the generality of his observations, as I believe this to be almost the only instance in which he is correct in his "Essay on the Laws of Gravity."

Remark.—If a small planet revolved round the earth at its surface, its period of rotation would be 1 h. 24′ 36″, in which case its projectile force would exceed its gravitating force upwards of 1600 times, its projectile velocity being 4.9 miles per second, while that of gravity is only 16½ feet: this is the least projectile velocity which will carry a body round the earth. If a projectile velocity greater than this, and less than about 7¾ miles per second, be communicated, its orbit would be an ellipsis, the perihelion point of which would be in the point of departure. If the velocity of projection were 7¾ miles per second, or greater, the body would not return to the earth: for, in the first case, it would describe a parabola, the summit of which would be in the point of projection; and, in the latter, it would describe a hyperbola, *and bid the earth good bye!*

Sept. 1827. J. UTTING.

PERKINS'S STEAM ARTILLERY.

Extract of a Letter from Mr. Perkins to Dr. Jones, Editor of the American Mechanics' Magazine.

"I am now engaged in building steam artillery, as well as musketry, for the French Government. The English Government would certainly have adopted this invention, had it not been for the gratuitous and false statements of certain engineers, who declared, that although I was able to make a great display at the public exhibition made by order of Government, yet it was delusive; and that I had never made a generator which stood for a week; and that I could not keep up the steam for more than two or three minutes at one time. These statements obtained credit the more readily, as any improvement in the art of war, which could be adopted by other powers, and which would have a tendency to place the weak upon a par with the strong, appeared likely to benefit other countries more than England.

The French Government have determined to give our new system a fair trial. A series of experiments have been made at Greenwich, which were attended by the French engineers appointed for that purpose, by the Duke d'Angoulême, together with one of his aids, and Prince Polignac. Their report was so satisfactory to the French Government, that a contract was immediately made. An English engineer of the first class, and one who is very much employed by this Government, has joined me in the guarantee of the four points which some of the English engineers have doubted; namely, the perfect safety of the generator, its indestructibility, the ability to keep the steam up, at any required temperature, for any length of time, and its great economy.

"The piece of ordnance is to throw sixty balls, of four pounds each, in a minute, with the correctness of the rifled musket, and to a proportionate distance. A musket is also attached to the same generator, for throwing a stream of lead from the bastion of a fort, and is made so far

portable as to be capable of being moved from one bastion to another. This musket is to throw from one hundred to one thousand bullets per minute, as occasion may require, and that for any given length of time. It was an observation made in my hearing, by his Grace the Duke of Wellington, that any country, defended by this kind of artillery, would never be invaded; and I am very confidently of this opinion.

"As soon as this machine is completed, it is to be exhibited to this Government, and to several engineers from other powers, who are over here for that purpose. I have no fears for the result, neither has Mr. Lukens, since he witnessed the experiment made for the French Government. He saw the steam gun discharge at the rate of from 560 to 1000 balls per minute, and the steam blowing off at the escape valve during the whole time; he is equally confident with myself, that the steam may be kept up in such a manner as to discharge a constant stream of balls during the whole day, if required. As regards economy, I am within the truth, when I say, that if discharges are rapid, one pound of coals will throw as many balls as four pounds of powder.

"It has been stated as an objection to the steam gun, that it would take too long to get up the steam, in case of an attack. To this I answer, that a very small quantity of fire will keep the generators sufficiently heated, when there is no water in them; and that when there is any chance of their being suddenly wanted, they should be kept heated in this way. The heat of the generators would last long enough to give off steam, until the fire is sufficiently increased to furnish a constant supply. For naval purposes this cannot be an objection, as the steam must always be up. Lord Exmouth, after witnessing a few showers of lead, observed, that he believed the time would come, when a steam gun boat, with two steam guns in her bow, would conquer any line of battle ship; and Sir George Cockburn said, that the mischief of it was, it would be to nations what the pistol was to duellists, it would bring all, whether strong or weak, upon a par.

"To prove the safety of my engine, I have worked it under a pressure of 1400 lbs. to the square inch, or at a hundred atmospheres, and cut off the steam at one twelfth of the stroke: this was merely to manifest what could be done with perfect security. My usual pressure is 800 lbs. per inch, cutting off at one eighth, and letting the steam expand to below 100 lbs. per inch. I let off at the dead point, at one flash; the manner of doing this I long to explain to you, but must first get my last patent sealed."

NEW THEORY OF THE SAFETY LAMP.

An interesting paper on the nature and properties of flame was read by G. Libri, at the *Société des Georgophiles* (Florence), on the 3d of December, 1826. The author was led to doubt the correctness of the theory or explanation given by Sir H. Davy, in order to account for the phenomenon of his safety lamp. The distinguished inventor ascribes the security which the lamp affords to the conducting power of the metallic gauze, by which it is supposed the temperature of the flame is so much lowered, as to be insufficient to ignite the inflammable mixture on the outside. Some facts known to the author were at variance with this hypothesis; and he found, upon trial, that when single rods were made to approach a flame, the latter was always inflected on all sides from the rod, as if repelled by it; and that this effect was independent of the conducting power of the rod, whether good or bad. The amount of inflection, or repulsion, was directly as the mass, and inversely as the distance of the flame. It was not diminished by increasing the temperature of the rod, even to such a degree as to render it scarcely possible for it to abstract any of the caloric. In fact, when two flames are made to approach each

other, there is a mutual repulsion, although their proximity increases the temperature of each, instead of diminishing it.

"From these principles," says the author, "the real theory of the safety lamp is deduced. A metallic wire, exerting, according to its diameter and its own nature, a constant repulsion upon flame, it is evident that two parallel wires, so near each other as not to exceed the distance of twice the radius of the sphere of repulsion, will not permit a flame to insinuate itself between them, unless it is impelled by a force superior to the intensity of repulsion. If to these two wires, others be added, a tissue is formed impenetrable to flame, especially when the conducting power of the wires adds its influence to that of repulsion." The author conceives, that, from the views above stated, the number of cross or horizontal wires in the Davy lamp is unnecessarily large, and that by rejecting all of these, excepting a number sufficient to secure the firmness of the tissue, the lamp would afford as great a security as at present, and at the same time diffuse a much greater light. This conclusion he is stated to have verified by actual experiment.

PILE DRIVING.

Sir,—It was not without surprise that I read, in your 209th Number, another communication upon this subject. I will not dispute but what Mr. Barrat's solution may be as accurate as Mr. Mackinnon's; but I will humbly maintain that they are both equally wrong. Is it possible that these gentlemen should not perceive, that they are only giving a relative instead of the actual value of the momentum of falling bodies? Their calculations are not founded on any certain data. Mr. Mackinnon admits, with great readiness, that a falling body passes through a space of 193 inches in the first second of time in the latitude of London. But has he ascertained this by experiment, or does he take it for granted from what he has heard or read on the subject? Mr. Lake is rather angry that I stated that his calculation was not according to his own rule, and defies me to prove it. Why, Sir, his own letter, in Number 192, acknowledges the fact. He there says, "As plain as I could possibly explain myself, I said that the rule given was a rule for finding the *comparative forces*, and I never designed it as a rule for finding the *absolute* forces." Why, if this were his intention, did he answer the original question in these terms—"Thus, in the proposed quotation, the weight of the ram is given $=6$ cwt. and the space fallen 20 feet; we have, therefore, $6 \times \sqrt{20} = 6 \times 4{\cdot}47 = 26{\cdot}82$ for the REQUIRED FORCE." (See Number 175.) Now, Sir, the required force was the absolute force which, according to his own acknowledgment, his rule was not intended to find, yet he gives the answer positively 26·82.

"Aries" having corrected his original communication, his rule is, in fact, precisely the same as my own. Mr. Andrews calculates that the force is doubled with a fall of 1½ inch instead of 1¼, on the authority of Dr. Walker and his own experiments. I think Professor Millington, in his published lectures, gives the latter; and, as far as I have been able to ascertain the fact, I am inclined to think he is correct for the latitude of London: however, this would make no difference in the mode of calculation, only, upon Dr. Walker's hypothesis, a, in my formula, $= 1{\cdot}5$ instead of $1{\cdot}25$, which latter number I have used in calculating my tables.

It is assuredly very *ingenious* in Mr. Mackinnon, to make use of tables calculated upon data which he had previously roundly asserted to be erroneous (because he happened not to have heard of them), in answering a question of mine. I am much obliged to him for the trouble he has taken, but must differ from him as to the question having no maxima or minima; in theory he is right, but in practice it is different. For example, an engine 100 feet high would be so unmanageable as to be totally useless;

and, on the other hand, it must be at least sufficiently high to admit the piles under it that are to be driven. My object was to turn the attention of your correspondents to the best possible *construction* of pile engines for general purposes; and I must confess that, perhaps, in the hurry in which I wrote the postscript to my letter, I did not clearly explain what I meant. The best engines of modern times are far superior to those in use some years ago, and no doubt they still admit of further improvement. In fact, improvements are continually being made by individuals, who would confer a benefit upon the public by communicating them through the medium of your Magazine.

I am, Sir,
Yours,
GLEVUM.

P. S. I have omitted noticing the latter part of Mr. Mackinnon's letter, wherein he observes, "The labour of raising the ram 16 feet is evidently four times that of raising the same 4 feet; CONSEQUENTLY the same power that will raise any weight 16 feet, will raise four times that weight to the height of 4 feet!" &c. Now, only think, Mr. Editor, what fools practical men must be, not to have found out this before. Here have I four lazy fellows, who have been slapping away at a set of piles, with a ram of about 4 cwt., which, with the help of a windlass, they contrive to raise so as to have a fall of 16 feet. I accordingly ordered my foreman to substitute one of 20 cwt., which they might as easily raise 4 feet, and, by taking breath, another 4 feet; and so on. But, Sir, what do you think? Although I showed him Mr. Mackinnon's authority, the impudent rascal laughed in my face.

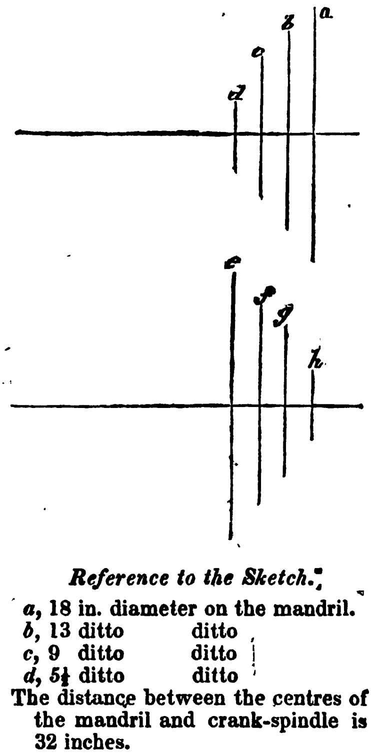
G.

TURNING LATHES.

Sir—I should feel much obliged to any of your ingenious correspondents, if they would favour me with answers to the following queries:—

I am constructing a turning lathe, and have four different speeds to it, and wish to make the pulleys in such proportion, that the same catgut band shall measure them alike, as is the case with lathes of the best makers.

The size of the pulley on the mandril, as per sketch, and the size of the largest rigger on the crank-spindle, is 22 inches diameter.



Reference to the Sketch.

a, 18 in. diameter on the mandril.
b, 13 ditto ditto
c, 9 ditto ditto
d, 5¼ ditto ditto

The distance between the centres of the mandril and crank-spindle is 32 inches.

e, 22 inches in diameter.

Now, what should be the sizes of the pulleys *f g h*, to answer the required purpose? and what is the readiest method of finding their proportions?

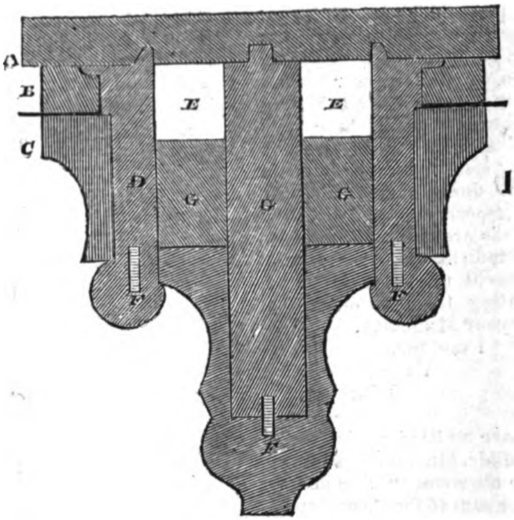
With every good wish to your useful publication,

I am, Sir,
Yours, &c.
A CONSTANT READER.
City, *Sept.* 14, 1827.

IMPROVEMENTS AT WINDSOR CASTLE.

(From the Communications, chiefly, of Mr. C. Davy.)

CONCLUSION.



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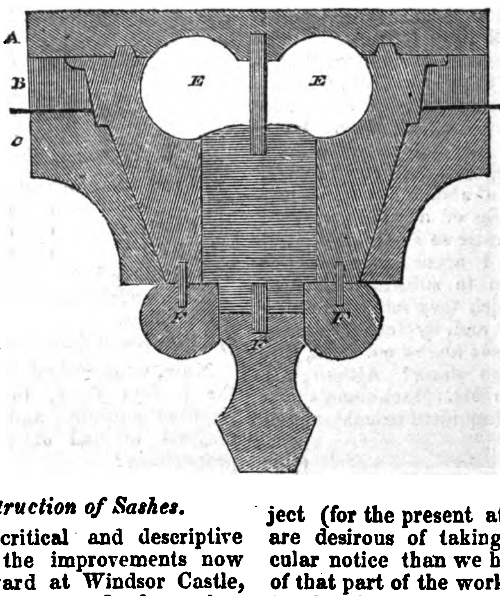


2

Construction of Sashes.

In our critical and descriptive notices of the improvements now going forward at Windsor Castle, we have hitherto confined ourselves chiefly to the external architecture; but, before taking leave of the subject (for the present at least), we are desirous of taking more particular notice than we have yet done of that part of the works which falls to the share of the carpenter and joiner.

So numerous have been the blun-

ders of late in our public and private works, and such lack of judgment has been generally exhibited in the interior details of buildings, that we are certain a notice of any subject of this description, and of real worth, must do good. We have, for our present purpose, selected the mode of constructing the sashes at Windsor Castle, as being on the whole extremely novel, and possessed of great practical merit.

Let figs. 1 and 2 represent the two methods of framing the Gothic muntins; A is the back lining, with the piece D, of oak, tongued into it; B is the lower sash, (the top sash is fixed,) one side of which is faced with copper; C is a piece answering the purpose of a sash bead, and which is screwed to D; the reason of this is, that, if the sash B is required to be taken out at any time, by unscrewing C this may be easily accomplished. The mouldings of the muntins being stuck separately, are keyed into the main framing, shown at F F F, figs. 1 and 2. The letters E E, in both figures, show the situation of the sash weights, parting slips, &c. The drawings here exhibited are made one-third of the *actual size*, and the figures in each drawing refer alike to both.

The walls of the state apartments are battened with frame battening, and carefully covered with paper, preparatory to receiving the rich crimson silk hangings of British manufacture, which, it is said, will cost more than 80,000*l*. The specimens which have been seen are described as being superior to any thing of the kind ever produced, either at home or abroad. Let us hope that, as his Majesty has set so excellent an example, in giving the preference to our home silk manufacture, it will be followed generally by our nobility and gentry, and this long depressed branch of trade become thereby inferior to none in extent and prosperity.

MR. HOOKEY'S IMPROVED RUDDERS.

Sir,—I observe in the last Number of your Magazine, a paper by "A Friend," in which an attempt (not the first) is made to deprive Mr. Hookey of the merit of having invented an improvement in ships' and boats' rudders, which had the honour (along with some other nautical inventions of his) of being rewarded by a Gold Medal from the Society of Arts, in the year 1820. The writer claims the credit of the invention for Mr. Weekes, of Chatham Yard; or rather, I should say, the credit of having constructed a rudder, similar, but yet so superior, to Mr. Hookey's, that he affects to be surprised how any one could ever think of confounding the one with the other.

A sufficient refutation of the claim thus set up on the part of Mr. Weekes, will, I presume to think, be found in the enclosed extracts from the communication made on the subject by Mr. Hookey to the Society of Arts; to illustrate which, I also send, for your inspection, the actual model from which the drawings there referred to were taken.

Mr. Weekes, it will be observed, or at least his "Friend" for him, does not pretend that the improved rudder which he claims as his, was invented *prior* to Mr. Hookey's. It is admitted, that when Mr. W. brought forward his plan, in 1819, Mr. Hookey recalled to notice "a mode for effecting the same object in ships and vessels, which *had been formerly applied by him to boats*." The fact is, that this "old mode" of Mr. Hookey's, as your correspondent very properly styles it, had been adopted by him in practice ever since the year 1813; while Mr. Weekes was not heard of as an improver of ships' rudders till 1819.

Now, then, as to the difference between the two rudders, which your correspondent pretends to be so great as to entitle Mr. Weekes to all the merit of an original inventor; if your readers will compare the description of Mr. Hookey's rudder, as contained in the following extracts, with the description of that *afterwards* brought forward by Mr. Weekes, as described by a "Friend," in your 209th Number, they will perceive at once, that the grand feature of both is identically the

same—namely, the cylindrical construction of the rudder and stern post, so that the one shall work exactly in the groove of the other. All that Mr. Weekes has done by way of alteration, is to limit the cylindrical construction to the lower parts of the stern post and rudder (as to the pretended advantages of which I shall here say nothing); and because he has only *partially* adopted Mr. Hookey's mode of construction, (borrowing the principle of it, however, entirely, and introducing no other,) his "Friend" thinks it just and becoming to claim for him as much merit as if he had been the actual inventor!

It it scarcely necessary for me to add, that whether this cylindrical mode of construction was at first applied to boats only, or to both ships and boats, that is a circumstance which can neither in one way or another affect the originality of the invention itself.

Leaving the case, with perfect confidence, to the candid judgment of your readers,

I remain, Sir,
Your obedient Servant,
A Friend of Mr. Hookey's.

Deptford Yard,
Aug. 28*th*, 1827.

Extracts from the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, Vol. 38, *for* 1820.

Mr. Hookey to A. Aiken, Esq. Secretary, &c.

Woolwich Yard,
Jan. 27, 1820.

Sir,—I had the honour of addressing a letter to you some time since, in order to claim, as my own invention, a plan laid before the Society by another person, relative to the construction of ships' and boats' rudders; I now beg to present to the Society models of my rudders, which I have adopted ever since the year 1813.

Before I employed this plan, I had convinced myself that generally the rudders of all vessels are much too heavy; so that, in fact, the rudders incur weakness by that which was intended to give them strength; as their great weight destroys, or has a tendency to destroy, the pintles and braces, which are their only security. I therefore reduced the weight of the rudder very considerably, and by attaching it in the manner shown in the models, I increased its power; the effect being thus rendered sensible the moment the tiller is moved from the middle line. According to the same plan, large scores were cut in the rudder below the surface of the water, and a great vacancy was left between the rudder and vessel, whereby much water escaped, and the tiller was in consequence obliged to be put over before the effect was felt; and by this means a great body of water was carried along, which must necessarily retard the rate of sailing. That much power must necessarily be lost in the way I have described, will be obvious, if we consider what would be the effect of boring great holes in the rudder; in this case, it is evident much fluid would escape without producing any effect; and just in the same way does the water, as I have described above, escape between the vessel and rudder. My object has been to follow nature as nearly as possible; and, looking to the tail of a fish for my example, I have endeavoured to construct my rudder to operate in the same manner. How far I have succeeded is not for me to determine; but on this head I cheerfully leave my claim in the hands of gentlemen in every way competent to judge of the merits of my construction.

I have the honour to remain,
&c. &c.
WM. HOOKEY.

Description.

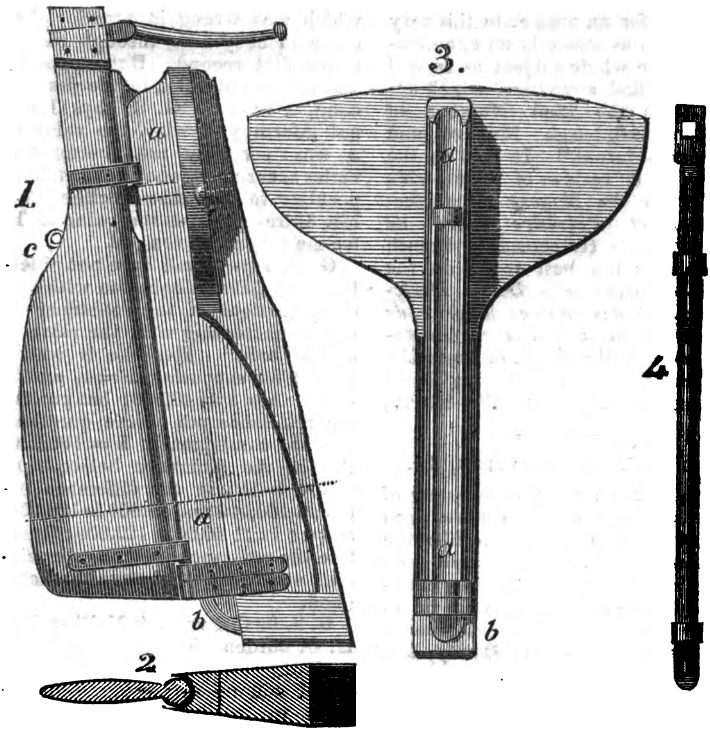
Fig. 1 represents a full side view of the stern post and rudder, on Mr. Hookey's improved principle.

Fig. 3, a horizontal section of the above.

Fig. 4, an end view of the stern and stern post, without the rudder.

Fig. 2, is an edge view of the fore part of the rudder.

a a (Fig. 1) is the false stern post, having a circular groove to receive



the rudder, the fore part of which is cylindrical; by which means the water is prevented from entering between the stern post and rudder, which adds power to the rudder, and does not retard the boat.

b is a chuck to prevent ropes from getting between the stern post and rudder; the groove in the stern post is a guide for directing the pintles into the braces when shipping the rudder.

c is an eye bolt for a man to take hold of, in case of his being near the rudder when fallen overboard by any accident.

ANATOMICAL PREPARATIONS.

Sir,—I should be greatly obliged if any of your medical or scientific friends could inform me where I may purchase a work of good repute and well recommended, on the best methods of preparing and preserving anatomical preparations of all sorts, but more particularly dried ones. There is so much professional puffery, and so much trash trumpeted forth in medical reviews, that no dependence can be placed on them. The opinion and direction of a disinterested medical man will therefore be very much esteemed; and, in the hope of procuring genuine information, I am induced to throw myself on your kindness for the insertion of this inquiry.

I am Sir,
Your obedient Servant,
T. M. B.

[While inserting this inquiry of an esteemed correspondent, we must enter our dissent from the censure which he has passed on our medical contemporaries, some of whom we deem to stand justly high both for integrity and ability. We may refer

T. M. B. for an answer to this very inquiry, to as masterly an examination of the whole subject as he will probably find anywhere, which appeared in the 72nd Number of "The Edinburgh Medical and Surgical Journal." It was in the form of a review of "Dumeril's *Essai sur les Moyens de perfectionner et d'etendre l'Art de l'Anatomiste* (esteemed by French anatomists the best work on the subject), Breschet's *De la Desiccation, et des autres Moyens de Conservation des Pieces Anatomiques*, and Mr. Swan, of Lincoln's, "New Method of Making Dried Anatomical Preparations."—EDIT.]

ON G. S.'S RECANTATION, &c.

Sir,—I am sorry that so many of your valuable columns have been occupied by a discussion like the one of Messrs. Ford, Russell, and G. S. *versus* myself. Those gentlemen have successively written to prove the fallacy of an assertion I made in support of Mr. Darley, and have as regularly failed.

I have just read the "Recantation of G. S."* in your present Number (217, p. 228), where he says, that "after duly pondering over my last three communications (pp. 186, 187, 188), he finds himself compelled to convert to my *new* systems of Algebra, Geometry, and Natural Philosophy." Here I shall remark that I never laid any claims to *originality* in those systems; and that, though they may appear *new* to G. S., I am sure they will not do so to any one who has read on the subject.

G. S., after making his recantation with respect to the case in Algebra, takes the liberty of occupying your pages with a critique of my letter "On Mr. Shires' Method of finding the Height of a Balloon." Here he has so proved his entire ignorance on *this* subject, that I shall say but few words by way of comment. Mr. Shires said $h = 16\,T^2$, which was wrong in practice, because no body falls through 16 feet in the first second. But supposing $x =$ the height fallen in the first second, $x\,T^2 = h$. G. S. says I did not inform you what the value of x was: certainly not, because it varies according to the circumstances peculiar to the case; neither has Mr. Shires given us the value of T, for the very same reason!

G. S. says that I have not "fettered my general equation with any considerations of the resistance of the air increasing with the velocity of the ball." Here he is wrong again: for supposing $x = 4$, and T $= 100$, then $h = 40{,}000$; but putting the resistance out of the question, $x = 16$, consequently $h = 160{,}000$. But as the difference between 16 and 4 is 12; so the difference between 160,000 and 40,000 is 120,000, and $4 : 12 :: 40{,}000 : 120{,}000$; therefore the resistance varies as the velocity, and the general equation holds good.

G. S. further says, "Neither does H. O. burden his general equation with any consideration of the time sound will be in moving from the earth to the balloon." No; my equation $h = x\,T^2$ only gives the *actual height* of the balloon, not the formula for aëronauts to find that height; Mr. Shires has already supplied *that*.

G. S. says he must postpone his remarks on my two other letters for a future number. I am duly sensible of the honour conferred on me by such distinguished and *extraordinary* notice; but hope I shall not be expected to acknowledge each of his criticising letters, *separately*, as they appear. In the mean time,

I remain, your's, &c.

HENRY OTTLEY.

Oct. 20, 1827.

* Rather unfortunate, after G. S.'s having so recently reproached Mr. Ford for *silently* walking out of the field!

IMPROVEMENT OF STEAM-BOATS.

Sir,—Ever since I first saw a steam-boat, it has occurred to me that the great loss of power, which evidently results from the plunging the wheel makes before it becomes effective, and the great quantity of water it brings up with the float-

boards behind, might be obviated. I have set my mind to work on the subject, and, I flatter myself, with complete success. The substitute I propose is free from all the objections I have ever heard offered to the present paddle wheel, and from the complexity of all the substitutes I ever heard described. But neither my circumstances nor pursuits favour my making experiments. If any scientific gentleman or practical engineer should feel inclined to make an experiment, I will describe it to him for that purpose, under certain restrictions, to which no reasonable person could object.

I remain, Sir,
Yours,
W. C.

London,
21*st Oct*. 1827.

P.S. In the hope that some application may be made to you on the subject, I send you my address.

BATTLE OF ANTS.

A paper by M. Hanhart, in a recent Number of the *Bull. Univ.* describes a very remarkable battle which he witnessed between two species of ants; one the *formica rufa*, and the other a little black ant, which he does not name (probably the *fofusca*).

M. Hanhart saw these insects approach in armies composed of their respective swarms, and advancing towards each other, in the greatest order. The *formica rufa* marched with one in front, on a line from nine to twelve feet in length, flanked by several corps in square masses, composed of from thirty to sixty individuals.

The second species (little blacks), forming an army much more numerous, marched to meet the enemy in a very extended line, and from one to three individuals abreast. They left a detachment at the foot of their hillock, to defend it against any unlooked-for attack. The rest of the army marched to the battle, with its right wing supported by a solid corps of several hundred individuals, and the left wing supported by a similar body of more than a thousand.

These groups advanced in the the greatest order, and without changing their positions. The two lateral corps took no part in their principal action: that of the right wing made a halt, and formed an army of reserve; whilst the corps which marched in column on the left wing manœuvred, so as to turn the hostile army, and advanced with a hurried march to the hillock of the *formica rufa*, and took it by assault.

The two armies attacked each other, and fought a long time without breaking their lines. At length disorder appeared in various points, and the combat was maintained in detached groups; and after a bloody battle, which continued from three to four hours, the *formica rufa* were put to flight, and forced to abandon their two hillocks, and go off to establish themselves at some other point with the remains of their army.

"The most interesting fact of this exhibition," says M. Hanhart, "was to see these insects reciprocally making prisoners, and transporting their own wounded to their hillocks."

It has been already known, from the observations of M. Huber, that when an ant-hillock is taken by the enemy, the vanquished are reduced to slavery, and employed in the interior labours of their habitation.

NEW PHENOMENA OF VAPOUR, EXPLANATORY OF THE BURSTING OF BOILERS.

M. Clement Desormes communicated, on the 4th of December last, to the Royal Academy of Sciences, some singular results relative to steam. When compressed in a boiler, and issuing in a violent and hissing jet, through an orifice made in a pretty large plate of a flat disk, if metal be presented to it, at a little distance from the orifice, the disk is strongly repelled; but if it be brought near, and placed against the plate, as if to close the orifice, although the steam issue on all sides like artificial fireworks, and press

against the disk more than before, not only is the disk not driven away, but it adheres to the plate, even when the jet is directed downwards. It remains suspended, in opposition to its gravity, and can be detached only by force. The same result takes place in an experiment with the wind which issues from the large bellows of a furnace.

Another fact, also curious, although already well known, is, that a current of steam from a boiler, in which it is very hot and much compressed, seems like a cool wind, compared with a current at one half the temperature and at one twentieth of the pressure.

From these first experiments, M. Clement concludes, that common safety valves, which consist of real disks placed upon openings in flat plates, present a danger inherent in their form. Scarcely are they raised so as to allow a thin plate of steam to escape, before it becomes impossible for them to rise higher; and if the production of vapour is too considerable for the small opening which may have obtained, and for the strength of the boiler, an explosion may take place, though the safety valve is open. This is, in fact, what sometimes happens, and which has hitherto appeared incredible. M. Clement has not time to give a full explanation of these singular phenomena. We only know that he attributes them to the vacuum which takes place in the current of steam, in consequence of the extreme swiftness of its particles, and of the conical form the current assumes between the adjacent plates. The current, from its great force, is so expanded towards the borders, as to become much less than the pressure of the atmosphere, which acts upon the moveable disk forcibly enough to resist the vapour.

The remedy for this danger is a good proportionate space between the orifice and their borders. The first should be large, and the others small. Besides, the addition of a conical tube to the safety valve would diminish the effect of atmospheric pressure, and of the weight with which they are loaded. M. Desormes thinks, that experiment alone can determine what is the best modification of safety valves to remove the danger he points out, and which has been so long unnoticed. He wishes the manufacturers to make the necessary trials, agreeably to the theory he has given.

ON MR. SHIRES' METHOD OF FINDING THE DIAMETER OF A ROUND STEEPLE.

Sir,—It appears to me, that Mr. Shires' directions for finding the diameter of a round steeple are rather obscure. When he says, "Two observers are to stand so as to see a star just appearing to touch its opposite sides," are we to suppose, that any two stars which may appear to two persons, so situated as to see the stars apparently touching the opposite sides of the steeple, will answer the purpose intended? But he says, the "position of one spectator from the other being at right angles to their direction from the respective sides of the steeple." Now, to render the stars of any service in the operation, they must likewise be in the same relative situation with respect to the steeple as the observers themselves; and what guide can two observers have to two stars being at right angles to the sides of the steeple, which would not at the same time be a guide to the parties themselves? And when once this rectangular position is taken by them, the diameter of the steeple is ascertainable without an appeal to the stars, or any other bodies on the opposite side of the steeple from them; since it is very evident, that the distance between two parallel lines drawn from the opposite sides of the circumference of a circle, will be the measure of the diameter of the circle. Another thing, too, I would observe: that the distance of the observers from the steeple would make a difference in the position of the stars to be viewed, in order to make a true calculation; as the further they are from it, the nearer to each other should the stars be, to have the re-

quired effect; and Mr. Shires has given us no rule to go by, in that respect. I have no doubt his method may answer the purpose; but the directions he has given are not, in my opinion, sufficient, for the reasons stated above; and likewise, they will only answer when the stars are visible, which is not a very good time, as I should conceive, for an admeasurement of any building.

In the hope that Mr. Shires will further elucidate his theory, by giving a fuller explanation of his method, and more copious directions for its performance,

I remain, Mr. Editor,
Your's, &c.
C. O. R.

London, Oct. 22, 1827.

EFFECT OF COLOURS AND LINES ON NEAR-SIGHTED PERSONS.

Sir,—I was in the Church of St. Ann, Blackfriars, a short time since, the end window of which is surrounded with a tri-coloured border, consisting of an outer and inner row of blue stained glass, with a middle of orange.

I am very near-sighted; and to me the border appeared very distinctly composed of five several colours, viz. an outer row of blue—the next pink—the centre orange—one of pink again—and the inner one of blue. It was not till just as I was leaving the church, that, on raising my glass, I discovered the true form and colours of the window.

If any of your readers will account for the above curious effect, on scientific principles, they will confer a particular favour on,

Sir,
Your obedient Servant,
Wm. Baddeley, Jun.

Oct. 18, 1827.

METHOD OF TAKING HONEY FROM THE HIVE.

Sir,—The following is an easy method of taking the honey from the hive, without destroying the bees:—

In the evening, when the bees are quietly lodged, approach the hive, and turn it gently over. Having steadily placed it in a small pit previously dug to receive it, with its bottom upwards, cover it with a clean new hive, which has been properly prepared, with a few sticks across the inside of it, and rubbed with aromatic herbs. Having carefully adjusted the mouth of each hive to the other, so that no aperture remains between them, take a small stick, and beat gently round the sides of the lower part of the hive, for about a quarter of an hour; in which time the bees will leave their cells in the lower hive, ascend, and adhere to the upper one. Then lift the new hive, with all it contains, and place it on the stand from which the other one was taken. The operation must be performed about midsummer, so that the bees may have time, ere the flowers be faded, to lay in a fresh stock of honey for their support during the inclemency of winter.

This practice is very general in France, Germany, and America; and I hope, Sir, that this communication, which I make to your valuable Museum, may be the means of its becoming so in Britain.

I am, with respect,
Your obedient Servant,
James Cox.

Nursery Place, Hackney, Sept. 5, 1827.

CHINESE PAPER.

This paper, of which so much use is now made in Europe, chiefly for copperplate impressions, is distinguished by its homogeneous texture, its smooth and silky surface, its softness, and extreme fineness. It is sold in very large sheets, some of which are four or five yards long, and a yard wide.

The Chinese fabricate their paper from different materials. In the province of Se-Tschuen, it is made of hempen rags, like the paper of Europe. That of Fo-Kien is made of the young shoots of the bamboo; that of the northern provinces, of the inner bark of a tree called ku-tschu, which is no more than the paper mulberry *(morus papyrifera)*.

It is this paper which is most commonly used in China. They resort to chemical solvents, and especially the ley of ashes, to bring it to a soft pulp, or paste; and they make use of rice-water, and other infusions, to render it properly consistent, and sufficiently smooth and white.

DIRECTION OF THE BRANCHES OF TREES.

A tree shoots out its branches like all other trees of the same species, external circumstances being similar. But Professor Eaton has noticed, in Silliman's Journal, one remarkable fact in the direction of branches, which he believes has not been previously adverted to. *All the trees with spreading branches accommodate the direction of the lower branches to the surface of the earth over which they extend.* This may be seen in orchards growing on the side of a hill, and in all open forests. This fact presents a curious object for the observation of the curious phytologist. The question presented is this: What influence can the earth have upon the branches on the open side of the tree, which causes them to form a different angle with the body of the tree from the angle formed by the branches on the lower side, so that all the branches hold a parallel direction to the earth's surface?

SINGULAR COLLECTION OF SILVER.

A correspondent of Professor Silliman's Journal states, that the mules employed at the amalgamating mines, in Mexico, are opened after death, and that from two to seven pounds of silver are often taken out of their stomachs. He says, that he is in possession of a specimen which is perfectly pure and white.

INQUIRIES

Which we have been requested to submit to our Correspondents.

For a method of restoring fresco paintings, which the inquirer has lately discovered in his parish church; they are at present whitewashed over, and have been so, perhaps, for centuries. He finds scraping takes off an equal quantity of the whitewash and colour, and that this method would, in the end, destroy them. By "An Old Subscriber," Sandhurst Lodge.

For the best method of cleaning old pictures. By "Sn. Ottar."

Is any advantage gained in power, by having a water-wheel higher than the surface of the water? and with what velocity should the circumference of a water-wheel move, to make the best of the power? By "Peter."

For the best luting or cement for stopping the escape of steam from the seams of a small experimental tin still, for essential oils. By "S."

For the way the Chinese make their rice ornaments, such as the pagodas, &c. By "S. W."

For the best manner of constructing a rack or drop-gate for a water-wheel, so as to regulate itself according to the velocity of the mill. Also, the best manner of constructing a water-wheel, which shall regulate a sluice-gate by means of a screw; so that when the water gets above a certain height, the wheel will draw the gate up as far as necessary, and when under a certain height, put it down; and thus keep up a head of water at an uniform height. The inquirer believes there is a drop-gate of the former description at Wandsworth, Surrey; and a wheel, such as the latter, at work at Lennord Bridge Mill, Norfolk. By "W. B." Narbro'.

NOTICES TO CORRESPONDENTS.

"Mr. Bayley," and "A Lynn Shipbuilder," on Messrs. Hookey and Weekes's Rudder Improvements, in our next.

Comunications received from A First Subscriber—S. Y.—B. F.—R. V., Jun. —123—Ignotus—Athelstan—Dav. Williams—A Millwright—Lapstone.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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Mechanics' Magazine,

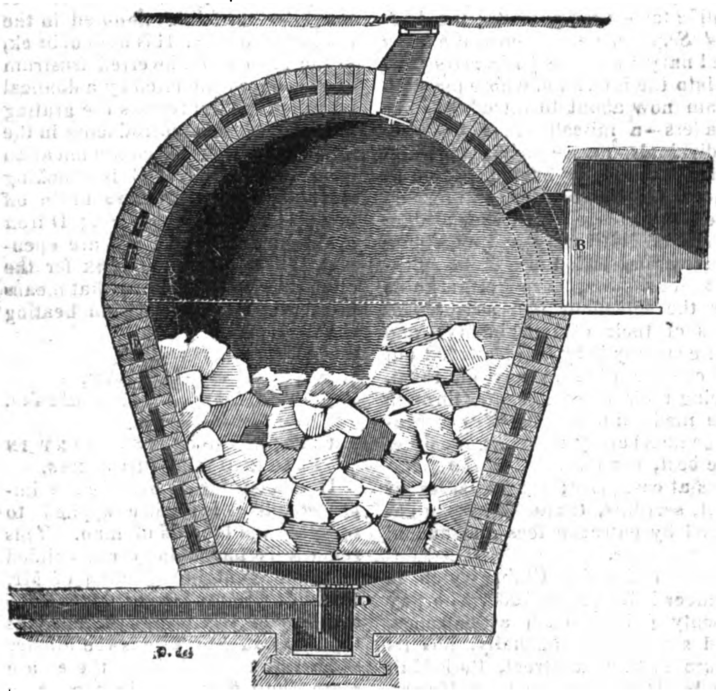
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 219.] SATURDAY, NOVEMBER 3, 1827. [Price 3*d.*

" Happy the man who sees a GOD employ'd
In all the good and ill that chequer life!
Resolving all events, with their effects
And manifold results, into the will
And arbitration wise of the SUPREME.
This truth, PHILOSOPHY, though eagle-eyed
In nature's tendencies, oft overlooks;
And, having found his INSTRUMENT, *forgets*,
Or *disregards*, or, more presumptuous still,
Denies the POWER THAT WIELDS IT."

COWPER.

UNIVERSITY CLUB ICE-HOUSE.



UNIVERSITY CLUB-HOUSE.

Sir,—Among the numerous establishments which serve to attest the progress which wealth and luxury have made amongst us, the new Club-houses in the western part of the metropolis hold a conspicuous place. As, probably, some of your readers are unacquainted with the nature of these clubs, it may be proper to state that the object they have generally in view is to enable particular classes of individuals to enjoy the pleasures of friendly intercourse on a more extensive scale, and yet with a greater attention to selectness, than is practicable on any other plan of association. Thus the *Travellers'* Club includes those, who, by their visits to foreign parts, are entitled to the appellation, *par excellence*, of travelled gentry; *the Athenæum*, such as are of literary and scientific tastes and pursuits; the *United Service*, gentlemen of the army and navy; and the *University Club*—into the interior of whose mansion I am now about to introduce your readers—a miscellaneous body of individuals, possessing in common the distinction of having studied at one of the Universities, and formed friendships there which they are desirous of cultivating and upholding in after life. All these clubs, without exception, are remarkable for the splendour and sumptuousness of their establishments; and yet economy is by no means left out of consideration in any of them. Being their own purveyors (through the medium of Committees of Management) every thing is not only of the best, but furnished to the members at cost price; the expenses of rent, servants, taxes, &c. being covered by entrance fees and annual subscriptions.

The University Club, which in number is limited to 1000, who pay twenty guineas each at entrance, and six guineas annually, has its house in Suffolk Street, Pall Mall East. It was designed by Messrs. J. P. Gandy and W. Wilkins, and exhibits a very tasteful combination of the Grecian, Doric, and Ionic orders; being a copy, as regards the latter, of the triple temple of Minerva, Polias, and Pandrosus, at Athens. Ascending a noble staircase, the walls of which are beautified by casts from the friese of the Parthenon, every visitor must be struck by the excellent manner in which the light is let in from above. Instead of a sky-light, after the ordinary modern fashion, twenty-five squares of coloured glass have been inserted into coffers of pannels; and a unity of character thus preserved, such as one rarely meets with where windows are introduced into Grecian designs. The principal apartments are a saloon, library, breakfast, coffee, and dining rooms; the whole of which are fitted up in a style of great elegance and comfort.

At the back of the building there is an ice-house, which cannot fail to attract notice for its simplicity and compactness. A sectional view of the interior of it is exhibited in the prefixed drawing. It is built of brick, in the form of an inverted frustrum of a cone, surmounted by a domical covering. A represents the grating for the purpose of introducing in the ice; B is a door of communication from the building; C is planking perforated with holes to drain off any water that may collect; D iron grating and drain; E E are openings left in the brick-work for the circulation of air, and by that means preventing the earth from heating the ice-house.

I am, Sir, &c.

C. DAVY,

Architect, 11, *Furnival's Inn*.

MR. PARKIN'S IMPROVEMENT IN BLACKSMITHS' CHIMNEYS.

It is pleasing to observe the improvements of science applied to mitigate the labours of man. This remark is particularly exemplified in the present introduction of Mr. Parkin's improvement into the smithery of His Majesty's Yard at Chatham, of which he is the Master Shipwright. Although there are more than fifty fires in the same workshop, it exhibits to the spectator the uncommon sight, under such circumstances, of a perfectly clear atmosphere. The toilsome life of

the blacksmith, amidst the mephitic and dense atmosphere of an extensive and crowded workshop, is thus considerably alleviated; and it is not unworthy the attention of the scientific philanthropist to inquire into, and make known, such an improvement.

Mr. Parkin's chimneys have not only the advantage of carrying off all the smoke produced by the combustion, but are economical in their use, as they produce a stronger heat by the greater draught and clearer atmosphere occasioned by them; and as the cinders are burnt more completely, the expense of the fires is not greater than before. Some calculations have been made to determine the diminution of expenditure thus effected, by which it appears that it amounts generally to a fifth of the value of the workmanship, and sometimes to a fourth; but circumstances must, of course, vary the extent of the saving.

The improved chimney is of an entirely new construction: instead of having the flue of the chimney above the fire, as it was previous to the new plan, it is placed behind it; so that, to a person unacquainted with the true pneumatical principle of forming chimneys (by having a rarefied current of air), as explained by Count Rumford, it gives the idea of an useless contrivance. A prejudice has thus arisen against the use of it, which it required the complete demonstration of facts to remove: the oldest blacksmiths, and even the master blacksmith himself, at the time of its introduction, in 1823, expressing themselves quite assured that the plan would fail.

As the space above the fire must be open, for the purpose of allowing the articles to be placed on the fire for forging, by a crane, the old chimney was placed above the fire about ten feet; so that in the distance to which the smoke had to ascend to the chimney, nearly the whole of it made its escape, and thus filled the workshop with smoke, at the same time that it caused the fire to burn less clearly. In the new mode, for the large fires, the chimney is composed of a large perpendicular hollow tube at the back of the fires, of 7 feet 4 inches wide, and 4 feet 7 inches deep, through which a small entrance for the smoke is made, of about 4 feet 9 inches broad, and 1 foot 6 inches deep, nearly at the height of the surface of the fire. As much depends on the exact focus of the current of the draught, Mr. Parkin made several experiments to determine it, of an ingenious nature, for the particular localities of Chatham Yard; as it is always in some degree dependent on circumstances.

The effect of the plan is most conclusive of its importance; as a rapid current of air carries off every particle of the smoke produced by lighting a fire. The satisfaction which the improvement has given to the workmen is pleasing in the highest degree. Many diseases previously engendered by the filth and smoke of the shop are now unheard of; and in the case of asthmatic complaints, to which the men were particularly subject, several have experienced the greatest relief.

OMICRON.

IRISH DEMONSTRATION.

Sir,—In No. 210 of your excellent Magazine I endeavoured to set the matter at rest as it regards "*the solution of imaginary or impossible quantities;* and take it for granted that I have done so to the satisfaction of every *algebraist* of the *Old Light Corps*, as G. S. very humorously styles them: nay, I will do H. O. the justice to say, that had he not been concerned in the subject, he would at once have subscribed to my article; a proof of which may be deduced, if any of your readers of the *Old Light* will take the trouble of reading his answer to my paper in No. 212, wherein he *has not*, with all his *manœuvring*, proved my calculations to be wrong; but *flies off at a tangent*, by informing us that Mr. Ford's letter (No. 208) is calculated to *mislead* your readers! and, as a *finale*, asks the definition and peculiar properties of an *Irish demonstration!!*

I was prevented from answering the query, by G. S., in No. 214, giving the definition which would have occurred to any one who has read my paper in No. 210, wherein it is said, that *if* what Mr. H. O. has advanced *be* a demonstration,

it must be an *Irish* one—for, in plain English, *it is no demonstration at all.* This *definition*, however, does not seem to satisfy Mr. H. O.: it therefore *seems* necessary that I should give my reasons for having introduced the above expression.

But, first, I beg leave most respectfully to announce to the Irish in general, and to all your Irish readers and correspondents in particular, that I mean it as no reflection on them, for I have the honour to be acquainted with many able mathematicians from the *Emerald Isle;* men of talent in every department of literature; men who would be an ornament to *any* country. But we frequently meet with *half-taught* men—men who have not *digested* what they have read ("A *little* learning is a dangerous thing"); and be they English, Scotch, or Irish, they generally *chatter* more on any subject than those who are better informed; which brings to my recollection a beautiful stanza written by an enlightened Irishman (Roscommon)—

"*One with a flash begins, and ends in smoke;*
Another out of smoke brings glorious light,
And, without raising expectation high,
Surprises us with dazzling miracles."

I am not aware that your correspondent, Mr. H. O., is an Irishman; had I thought so, I most certainly would not have introduced an expression which seems to have hurt his feelings.

But to the point—I am not an Irishman, and I am not an Englishman; but I was born and bred in the shire of Renfrew, not a hundred miles from the seaport town of Greenock; I therefore leave it to Mr. H. O.'s syllogistic powers and geographical knowledge to say what countryman I am. A vast proportion of the labouring classes of my natal place are Irish, who emigrate from their own country in quest of work: I, at one time, employed one of them to *dig* my garden; a shrewd and witty fellow he was. I asked him how long he would be in finishing a certain portion of it? "Why," said he, scratching his head at the same time, "*have it finished, master?* why, I shall finish *that* '*in the boiling of an egg.*'" (Query, the time an egg should be boiled?) I next asked him how many berry-bushes there were in the garden, which were planted at equal distances, in the form of a parallelogram, there being eight in the longer and three in the shorter sides; and he answered me correctly, by saying there were 24 bushes altogether. I then asked him whether the number would be different, had there been six on the longer and four on the shorter sides.—"Why, master," said he, "I cannot answer that question at all, at all." "Well, Paddy," said I, "how many are four times six?" He immediately answered me correctly. "Well, Patrick," said I to him again (who by the by seemed rather in a pet because he could not answer my former question), "how is it that three times eight and four times six are the same?" After a short pause, he replied, "*Because they are the same.*" "But what *reason* have you for supposing them to be the same?" "Och, botheration to your questions, master; I know nothing about *reason* at all, at all."

Having mentioned this conversation between Pat and myself to a schoolmaster, who was rather a facetious character, he laughed heartily at the dialogue, and said that I had had a specimen of *Irish demonstration;* and ever after this, when an *unsatisfactory elucidation* was given on any subject by any of our friends, we were in the habit of jocularly styling it *an Irish demonstration.* Hence my reason for having, in the above case, introduced this expression.

Mr. H. O., saying that *his demonstration appears to be one which has posed G. S. and myself*, is something similar to a ferocious animal, who, after being *caged*, flaps his tail against the bars of his prison in menace of those who placed him in *durance vile.*

I am happy in having the honour of being classed with so efficient a correspondent as G. S. appears to be. His reasoning is built on the soundest principles, and his deductions are always correct.

Now, good bye to Mr. Ottley and to the subject; for I think I hear some of your readers exclaiming, What a *great bore* these *imaginary* calculations are! and others echoing to the tune of its being as *Wapping a bore* as the Thames Tunnel.

I am, Sir,
Your's respectfully,
WM. RUSSELL.

TWO NEW PRACTICAL THEOREMS IN THE DOCTRINE AND VALUATION OF ANNUITIES ON LIVES.

BY MR. JAMES B. BENWELL, ALBION ASSURANCE OFFICE.

Sir,—As the very excellent miscellany, "The Mechanics' Maga-

zine," appears to be open to the discussion of every subject of a scientific and practical nature at all valuable for its utility and application in the pursuits of life, I am induced to think that the present article is not inconsistent with the plan and object of the work; when regarded, as it properly may be, as a common depository of most interesting facts and observations in science and the arts, thus rescued and preserved from oblivion.

It is chiefly well known to calculators, as a principle on which the valuation of annuities for terms of years depends, that the values in all such cases will return, during the given term, the specific rate of interest allowed, along with the capital itself, provided this can be reproduced at the same rate accordingly.

The like supposition also applies in the valuation of annuities on lives; that is, in all such Tables the values will yield the given rate of interest therein, together with the surplus of annuity to secure the capital by a life assurance, supposing the premium thereon to be calculated from the same rate and Tables of mortality respectively.

Hence, in either or both of these conditions, if it is impracticable on such terms so to create and redeem the capital, it cannot otherwise, as is plain, wholly revert to the purchaser again when the contract shall cease and terminate. Examples, in illustration, may suitably be introduced here.

Conceive, of two annuities, one receivable for a term of 22 years, the other during an insurable life, aged 29; the annuity £100 per annum.

In the first case, the value at 5 per cent. will be £1316·3005, the interest on which is 65·815, and the surplus income £34·185; and the amount of this annual excess for 22 years is equal 34·185 × 38·5055 = 1316·3005, the capital originally invested.

Secondly, the value of the annuity on a life at an age 29, by the Northampton Tables, at 3 per cent, is £1710·70; the office premium of assurance on this is 47·26116, and their sum is 1757·96116; the interest on which is 52·73884, and this added, 47·26116 = £100, the annuity exactly; which conclusions being true of single lives, will also be so of joint lives and survivors.*

From what has just been explained as essential to the subject and foundation of the rules that are to follow, it will be obvious that, in the purchase of an annuity, either for a term of years, or for any given life, it is equally alike as to the resulting circumstances in the latter as in the former case, so long as the same, or an equal return of interest, is obtained beyond the premium of life assurance necessary for the redemption of the capital expended; and whence the excellent plan and medium presented by institutions for such purpose especially. But the investigations of mathematicians, however, as to their theorems and rules for the valuation of annuities certain and on lives, determine the same on the condition that the capital is always replaced from a fund of accumulation at the same rate of interest as allowed in the purchase; but such can never arise with an annuity certain, when the interest allowed exceeds 5 per cent., nor anywise with a life annuity, unless the interest and premium of assurance are computed after the same rate: whenever, therefore, these stipulations do not coincide, as from the very nature of these transactions must almost always happen, it must, at least, be desirable to possess a concise and simple method of deducing the values under the conjunct supposition specified herein; and which, in the particular instance of annuities certain, has been, and first of all, given by Mr. Morgan in the last edition of his "Doctrine of Annuities and Assurances;" and I have myself, in effecting an extension of the object as applicable in respect of annuities on lives, been furnished with the following neat analytical theorems, viz.

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* From the expression $(1-gA) \div (1+g) = S$, $(1-S) - (A+S) \cdot g = o$, which will assign all the different values symmetrical with A in the given cases, as referred to in the text above.

Theorem First.

$$\frac{(1+A\cdot(1+g)}{\frac{A+2+g}{D^2}\cdot(x^2+r\,x+r^2)\,S^2+(1+S\,r)\,x+D\,r-g\,A\,x.}$$

Theorem Second.

$$\frac{(1+2\,A).\,g-r+(1+g\,r).\,A}{x+x\,g+(r-g).\,(A+1)}$$

or $\frac{1-p\,x}{x\,(p+D-)}$, if p is the annual premium.

In the above theorems, the symbols are A, the value of the life at g, insurance rate of interest r, that on the capital advanced $x=(1+r)$: and in Theorem 1st, $S=(1-g\,A)$ and D the compound quantity in its numerator.

Theorem the second is certainly to be preferred for its compendious form of solution; but I have entitled both practical theorems, because in the general doctrine of life annuities by the direct summation of series, there is no deriving these results from any other abridged subsidiary process; the methods, therefore, pointed out, will be found of manifest importance and utility to those who are interested and engaged in making such deductions as these, in the valuation of leases and estates on lives.

Case 1st.—To find the value of an annuity of £100 per annum, on a life aged 30; so as to clear 5 per cent. on the capital advanced, and the premium of assurance at the "Equitable" rates or table, at 3 per cent. and Northampton mortality.

Here A=16·9287, S=·492349, D=18·459351, and the operation may in part be expedited by logarithms, thus:—

Log. $(A+2+g)$	. .	1·2776481
— $(x^2+r\,x+r^2))$	.	·0635210
— S^2	.	—1·3845460
		0·7257151
— D^2	.	2·5324328
		—2·1932823

Nat. number to which log., by the Tables, corrected for differences and proportional parts, is

	·015605665
$(\cdot1+S\,r)\,x=$	1·075848322
$D\,r$ . .	·92296755
	2·014421537
$A\,g\,x=$	·5330325
	1·481388

Now, by this number, dividing the quantity D, or 1·481388 ÷ 18·459351 = 12·4608, for the value as required. Taking A 16·922, gives for the value 12·461.

If the life had been at an age 40, and taking A 14·8476, produces for the new value 11·2563; but using 14·848 instead, the result is 11·2565: so, in any isolated inquiry, the excess plus in the 3d decimal place will be of no material effect in consequence.

In a recent volume of Tables on Life Contingencies,* by Mr. Davis, a compiler of them, is included one of this kind for single lives; but in no instance of joint lives, survivors, &c. is any value stated; which might as easily have been done, when deduced from such theorems as the above; since they at once readily generalize and extend to all these cases in their combined forms, as it may be worth while to exemplify.

Case 2d.—To deduce the value of an annuity of 100 per annum, during the joint lives of two persons aged 28 and 40, on the same conditions as of Case 1st. Here the value to be substituted for the joint lives AB=11·69025, by true calculation; and operating with Theorem 2nd, as in the succeeding cases:

(1+23·3805), ·03—·05+(1+·03.05). 11·69025=12·389200375 for a dividend, and 1·05+(1·05·03) +·02·12·69025 = 1·335305 for a divisor, and the quotient quantity equal 9·2782, for the value or year's purchase. If the ages had been 37 and 49; then A B = 9·94000, and the value deduced will be 8·0991. The simultaneous result by Theorem 1st is 8·1012.

* The "Preparatory" Table, inserted as founded on a New Theory of the doctrine, erroneously termed, is the very same in principle as that by the late Mr. Barrett, but under an abridged and disguised form however. Mr. B. was an ingenious man of science and of unostentatious pretensions.

Case 3d.—In which let the value be found for the duration of the joint lives, and of the survivor. If $(A-AB+B)=20\cdot4464$, then the value sought for the year's purchase equal 14·3561. By Theorem 1st, the value is 14·3562.

Case 4th.—Let the value be found for the joint continuance of three lives of the ages 35, 45, 55. By deduction from "Simpson's Rule," $ABC=8\cdot22723$, and the value educed from this is 6·8823: by 1st Theorem it is 6·8862.

Were the lives here aged 35, 45, 50; then, by approximation, $ABC=7\cdot83007$, and the value equal 6·5906, accordingly. The value, by Theorem 1st, is 6·5951. Were the ages 27, 37, 47, and the insurance rate 4 per cent., then, by Table in Dr. Price's Rev. Pay, $ABC=8\cdot027$, and the value found from this equal 7·3408. By Theorem 1st, the value is 7·341.

Case 5th.—Suppose the annuity to continue during the existence of any two out of the three first lives as above, here is first to be taken $(AB+AC+BC-2ABC)=14\cdot0789$, and the value$=10\cdot791$ for the year's purchase required. By Theorem 1st, 10·7915 is the value obtained.

The computist, if he is so disposed, may easily verify the accuracy of all the foregoing determinations. Having now illustrated the use and application of the Theorems in a sufficient variety of examples, it is unnecessary to pursue the subject any further; but observing, in this manner we might proceed in tabulating the values in these or any other proposed cases, by first of all, as has been shown, substituting for the variable term or subsidiary value designated by A, and the derivation of which will depend in order on the given conditions of survivorship therein.

JAMES B. BENWELL.
Albion Assurance Office,
Oct. 2, 1837.

ON RAILWAYS.

Sir,—I must beg of you to allow me to explain my opinions more clearly on the subject of railways, and to observe that in Mr. Mackinnon's quotation, vol. viii. page 311, line 34, left hand column "per mile," should have been "per minute," as was mentioned in the number following the one he quotes from. I must also remind him that my calculations, which he mentions, were not absolute, but merely comparative; and that I gave the authorities for their correctness, which, however, I will not dispute about.

It will perhaps be useless to enter into any controversy, as to what the "Scotsman" meant, or how he expressed himself; but I certainly understood him to mean that if a one horse power engine would be sufficient to balance the resistance caused by the friction of a carriage when going at the rate of one mile an hour, the same engine would be sufficiently powerful for the purpose, when the carriage was going at the rate of ten miles an hour, provided an additional power was applied for a short time, to get the carriage up to that speed.

Now, suppose a carriage to be drawn by means of a fixed engine; and that when the engine makes ten strokes in a minute, the carriage advances at the rate of one mile an hour: to draw the same carriage at the rate of ten miles an hour, the same engine must make one hundred strokes per minute; or ten times the steam must be expended in the same time. If a spring steelyard were interposed between the end of the rope and the carriage, we allow it would be drawn out to the same mark in both cases; but if the resistance is overcome with ten times the velocity, it must be at an expense of ten times the power, in the same given time. It is true, if a carriage has to be drawn 100 miles, the same expenditure of power will do it (as far as friction is concerned), whether it moves at the rate of one mile an hour or fifty. For, if a one-horse engine is sufficient in the first case, it must work 100 hours; and the expenditure is one-horse power employed for 100 hours, or $100\times1=100$. And, in the second case, a fifty-horse engine would be required, but it would only be employed two hours, and $50\times2=100$ as before. This is what the "Manchester

Guardian" says; the "Scotsman" meant. But he need not have been at the pains of writing two or three columns to prove that 10×4 is equal to 40×1, nor was there any danger of any "thorough-paced practical man" denying such a proposition. After all the puffs which have been put forth about the "Scotsman's" remarks, I will ask any *impartial* reader, whether he is not justly chargeable with falling into one of these errors:—Has he not either wilfully misrepresented the case, or expressed himself so badly, that the majority of his readers misunderstood him? or confused his own ideas by bad reasoning; and then abused the whole body of practical men, for a set of downright blockheads, because he had the "*penetration*" to foresee their opposition to deductions which were true nowhere but in his own imagination?

I will further ask—has not Mr. Mackinnon taken a great deal of trouble to complicate a simple question?

I am, Sir,
Yours very respectfully,
S. Y.
A Young Engineer.

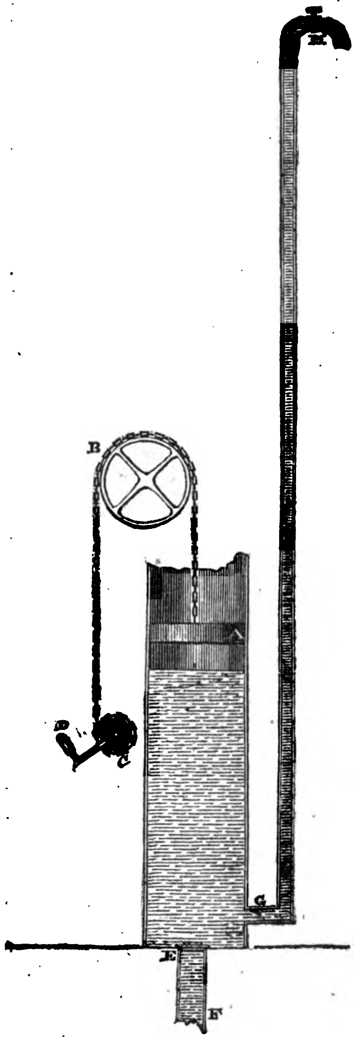
PUTTY FOR POLISHING MARBLE.

The following is the method of preparing polishing putty, or white oxide of tin, respecting which I see an inquiry in one of your late Numbers (see pp. 160, 287, vol. vii.)

If tin be melted in an iron ladle in contact with air, its surface will become covered with a grey pellicle; if this be removed as it forms, the whole metal will be gradually converted into a grey powder, which must be passed through a silk sieve to free it from some particles of metallic tin: let this powder be put into a crucible, and exposed to a red heat for some time, stirring it occasionally with an iron rod, till it has acquired a white colour. This is the putty used for polishing optical glasses, marble, steel, &c.

B.

PLAN FOR RAISING WATER TO THE UPPER STORIES OF HOUSES.



Sir,—At present, whenever a supply of water is required for any domestic purpose, to the upper rooms of a house, a force-pump is fixed, with a cistern for the reception of the water—a great incumbrance in any apartment, and an inconvenience which might be remedied by the adoption of the pump of which the following is an explanation.

"The cylinder (an old steam engine cylinder would answer the purpose) might be fixed in the yard of a house. This cylinder is supposed to be 4 feet in height, and 1 foot in diameter. The piston A is heavily loaded with lead, in the proportion of 15 lbs. to the inch; this is elevated by a chain working round the pulley B, by the wheel to which is attached the handle D. The elevation of the piston causes a vacuum underneath, which is immediately filled with water, by the pipe F, through the valve E, which descends by the gravity of the water. The piston being left to descend by its own weight, causes the valve G to open, and the water to ascend in the pipe to the height of about thirty feet, (the weight of the piston being 15lbs. on the inch). A supply of water for dressing, or for a water-closet, may therefore be had by the cock H; and as the cylinder will contain about fifty gallons, the elevation of the piston weekly will of course answer every purpose, and the whole expense would be but a few pounds.

If you will give insertion to this sketch, I may, perhaps, trouble you with another plan or two of the kind at a future time.

I remain,

Yours, &c.

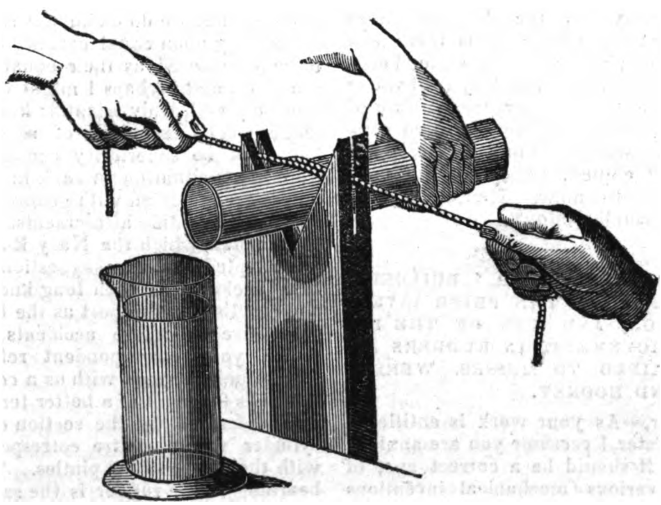
R. V.

9th September, 1827.

METHOD OF DIVIDING GLASS BY FRICTION.

BY DR. HARE.

(From the American Journal of Science.)



Some years ago, Mr. Lukens showed me, that a small phial, or tube, might be separated into two parts, if subjected to cold water, after being heated by the friction of a cord made to circulate about it by two persons alternately pulling in opposite directions. I was subsequently enabled to employ this process in dividing large vessels, of four or five inches in diameter; and likewise to render it in every case more easy and certain, by means of a piece of plank forked like a boot-jack—as represented in the preceding figure; and also

having a kerf, cut by a saw, parallel to, and nearly equidistant from, the principal surfaces of the plank, and at right angles to the incisions productive of the fork.

By means of the fork, the glass is easily held steady by the hand of one operator. By means of the kerf, the string, while circulating about the glass, is confined to the part where the separation is desired. As soon as the cord smokes, the glass is plunged in water, or if two large to be easily immersed, the water must be thrown upon it. This method is always preferable when, on immersing the body, the water can reach the inner surface. As plunging is the most effectual method of employing the water, in the case of a tube I usually close the end which is to be immersed.

Rationale.

If the friction be continued long enough, the glass, though a very bad conductor of heat, becomes heated throughout in the part about which the friction takes place; of course it is there expanded; while in this state, being suddenly refrigerated by cold water on the outside only, the stratum of particles immediately affected contracts, while that on the inside, not being chilled, undergoes no concomitant change. Hence a separation usually follows.

MERCHANT - SHIP BUILDERS' CLAIM TO THE PRIOR INVENTION AND USE OF THE IMPROVEMENTS IN RUDDERS ASCRIBED TO MESSRS. WEEKES AND HOOKEY.

Sir,—As your work is entitled a Register, I presume you are anxious that it should be a correct one, of the various mechanical inventions which are offered to the public, and to award the palm of originality where it is due. I am induced to trouble you with a few remarks upon a claim which has been set up in one of your recent Numbers (209) for the original invention of a plan, which, to my knowledge, has been in use amongst the *merchant-ship builders* of this port for many years previous to 1819; and now (like a plan which was suggested and acted upon by a merchant-ship builder, in this port, many years ago, in building His Majesty's ship Peacock), is claimed as the invention of an officer in one of His Majesty's dockyards. The plan alluded to, which was acted upon in building the Peacock, is that of bending the timbers after having run a saw kerf through the greater part of their length, and then bolting the two parts together. I do not wish to detract from the merit of the plan which is claimed as the invention of Mr. Weekes, and as such recommended to the attention of merchant-ship builders; but I do *wish* to vindicate my brother builders from the imputation, which is so frequently cast upon us by some of the gentlemen connected with His Majesty's dockyards, of not being able to make any improvement in naval architecture without their aid. We do not ask them to acknowledge our superior skill or science; but we do claim the right of standing upon equal ground, and to be considered as their equals in practical, and perhaps I might with propriety add, truly scientific knowledge. The republic of science knows of no superiority conferred from mere situation or rank in life, unless accompanied with genius and extensive scientific attainments.

The plan which the Navy Board has adopted, at the suggestion of Mr. Weekes, has been long known and practised in this port as the best preventive for those accidents to which your correspondent refers. It is usually termed with us a *coak*, (perhaps for want of a better term,) and is formed by the section of a cylinder whose centre corresponds with the centre of the pintles. The bearding of the rudder is the same, whether the plan is adopted or not; and it is evident that its utility will depend on the coincidence of the centre of the coak with that of the pintles. I have frequently had occasion to refit them after they had been worn away by the action of the water, &c.; in which case I have had them made nearly of the same

diameter as the siding of the keel abaft: this allows of their being securely bolted, in addition to the security obtained by *dove-tailing* them into the end of the keel.

That the plan is not extensively known is very probable, as a year or two since some gentlemen (from the River, I believe) were in my yard, and saw one in a vessel I was then building, which they told me was the first thing of the kind they had seen. I should not probably have known this, had I not observed them very curiously examining the keel of the vessel, and making a sketch of it; which induced me to inquire whether it was new to them. With regard to Mr. Hookey's plan, I may be allowed, perhaps, to say, that the only person benefited is the timber merchant, by the greater consumption of timber; and that a much greater risk of breaking the braces is incurred, by the distance which their eyes must project from the stern post.

I am, Sir,

Yours, &c.

GEORGE BAYLEY.

Ipswich, Oct. 11, 1827.

P. S. In looking over the foregoing remarks, I beg to observe that it is not my intention to insinuate that *all* the officers in His Majesty's dockyards are disposed to treat merchant-ship builders with contempt, as I know the contrary is the case, from personal experience; but what I complain of is that *esprit de corps*, which exerts such an influence over the less informed men amongst them, as to lead them to believe that nothing but absolute ignorance is to be found beyond the dock yard walls, and that those who have not received their instruction from the privileged few are perfectly incompetent to form any thing like a correct judgment of the improvements suggested from time to time in their profession.

Such should remember that a merchant-ship builder has frequently to construct his own draughts, and in all cases to direct the whole progress of building; which I am induced to believe is a greater stimulus to improvement than the officers of a dockyard are generally aware of.

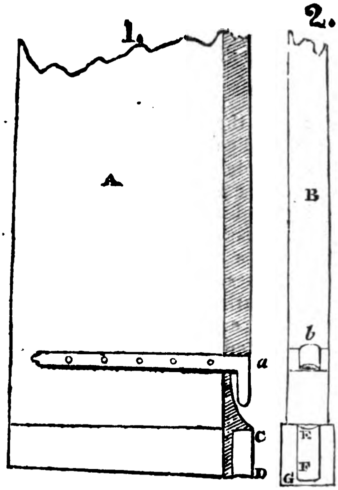
Sir,—In the Number of your valuable publication for August 25, a correspondent, signing himself "A Friend to the Mechanics' Magazine," has inserted a description of what he conceives to be a recent improvement in the rudder, introduced by Mr. Weekes, and recommending its application to vessels in the merchant service, from its having been adopted by the Navy Board.

He states the improvement to consist in the lower end of the rudder revolving round a cylindrical termination of the keel; the heel of the rudder being also cylindrical for that purpose. Now, without wishing to raise a doubt as to the idea having originally occurred to Mr. Weekes, or intending in the least to detract from that gentleman's ingenuity, I beg leave to state that precisely the same principle in the construction of the rudder has a long time been used generally in merchant vessels (and I may say invariably so, with those built at the port of Great Yarmouth); with this difference, that instead of the cylindrical termination of the keel acting within a corresponding concavity or groove at the heel of the rudder, the rudder, at its heel, has the cylindrical termination acting within a corresponding concavity at the end of the keel, which projects beyond the line of the stern post; and it may not be improper to add, that as the concavity is only carried partly through the depth of the keel, the part which overlaps the cylindrical termination of the rudder must consequently operate as an additional security against the intrusion of ropes or chains between the rudder and the stern post.

The annexed drawing may be deemed necessary to elucidate the subject, by the insertion of which, you will oblige

Your very obedient Servant.

W. Y.



Description of the Drawing.

A represents a side view of the lower part of the rudder; B a front view of the lower part of the stern post; *a* the pintle, which slips into the gudgeon *b*; C D the cylindrical termination of the rudder, which works within the corresponding groove; E F is the extremity of the keel, the lower part of which, at G, over-laps the under end of the cylinder C D.

ANSWERS TO QUERIES ON HANGING SHIPS' RUDDERS.*

Sir,—In No. 190, Vol. vii. of your valuable work, I observe a few Queries, by Amicus Publico, respecting my plan of hanging ships' rudders. In answer to which I beg to state,

First. The rudder cannot be unshipped without putting the vessel in a dry dock, or on stays, which did not strike me at first.

Second. Amicus Publico's iron rod is certainly the improvement required; but it ought not to be rivetted at the bottom, but left loose, or made to rest in a stanchion at the foot of the stern post, and fastened to the rudder-head or stern-post, to prevent its working out. The pivots should still be placed alternately, leaving the greatest number for the rudder to hang on, which will not allow it to be unshipped in a heavy sea. The rod can be unfastened at the top, and hove on deck by means of a pulley, which will unship the rudder much easier than the one new in use can be.

Third. I should think a small bolt passed through the pintle would make it rather weak.

Fourth. I do not know of any advantage that could arise from not having the rudder to unship.

Fifth. Answered by No. 1.

Sixth. I would say No.

Trusting this explanation will suffice, and feeling grateful to A. P. for his improvement,

I am, Sir,
Your most obedient,
G. M. J.

* This communication should have been inserted sooner, but was unfortunately mislaid.

PUMP QUESTION.

Sir,—In No. 214 of the "Mechanics' Magazine," I observe an inquiry respecting pumps, and in No. 217, a reply, by Mr. H. Ottley, who says, "I think there can be no *doubt* but that the current, being under the mouth of the pipe, &c. must tend to increase the labour," &c. &c.

I can, however, put *this* part of the question *beyond a doubt*, as I have a pump working from a cistern of *still water*, at the depth of twenty-eight feet, subject to the inconveniences enumerated by Mr. H. Ford; and I can only account for it by supposing, that, as the column of water in the feed-pipe is nearly a balance for the atmospheric pressure, the water rises to that height with very little velocity compared with its motion in pumps where the column is shorter. I know no experiments on the upward motion of fluids in tubes, to which I can refer for correct information on this head; but I am of opinion, that the velocity of a fluid rising up a tube *in vacuo*, diminishes in proportion as the water approaches that point at which it is in equilibrium with atmospheric pressure.

Neither the alteration proposed

by Mr. Ottley, (notwithstanding the *enticing* shape of the funnel), nor lengthening the feed-pipe, will produce any good effect. The only certain remedy would be, to bring the pump and the supply of water a little nearer to each other. In Mr. Ottley's last paragraph he informs us, that if the funnel were used, "the *upward pressure* of the water would tend to prevent the closing of the piston-valve in its descent!!!" This difficulty can, however, be got over, as he tells us, "by making the valve of such a weight as to counterpoise this pressure." Then why not take away the whole concern of pumps, pistons, weights, &c. &c. and leave this good-natured water a *free entrance* into the desired cistern?

I remain,

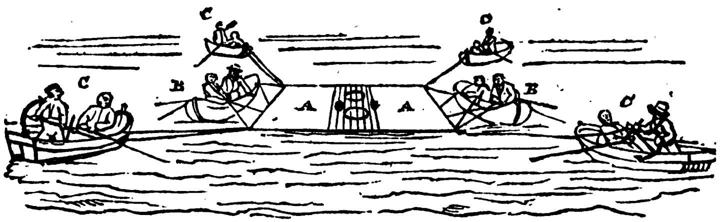
Yours respectfully,

WM. BADDELEY, Jun.

October 27, 1827.

MODE OF PROTECTING EXCAVATIONS UNDER RIVERS FROM INUNDATION.

BY MR. EDWARD CAREY, NAVAL ENGINEER, AND SURVEYOR OF SHIPPING, BRISTOL.



Sir,—I beg leave to lay before you a plan for protecting excavations under rivers from inundation during their progress, which, if adopted in the case of the Thames Tunnel, would have prevented the disaster which recently befel that undertaking.

A A is a piece of matting, made of 1½ rope, 24 feet square, thickly thrummed on one side, and covered on the back or upper part with thick canvas, and tarred over.

B B are two boats moored, with the matting suspended between them, ready to lower down when the boats C C C C have let go their anchors to moor the matting.

The two ovals in the centre of the matting are supposed to indicate two such apertures in the bed of the river, as those which lately interrupted the progress of the Thames Tunnel, and the vertical lines *o o* iron flat bars, or a large plate of iron dropped down over these apertures. The matting, when sunk, and in its proper place, is to lie on these iron bars or plate, which may be very easily managed by veering and hauling in the boats C C C C. It is to be loaded with bags of clay, sand, and shingle ballast. The greater the pressure, the more effectually will the water be kept out; and as the workmen will perceive that it will be totally impossible for the water to break in upon them, with such security over their heads, they will go to work cheerfully, being assured no accident can happen to them even if they were to work up close to the under part of the matting.

I am, Sir,

Your obedient Servant,

EDWARD CAREY.

Bristol, Aug. 3, 1827.

IMPROVED RAT-TRAP.

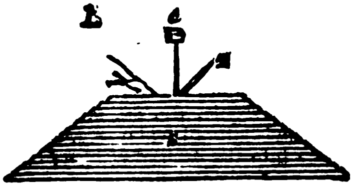
Sir—My house being infested with those destructive vermin, rats, and finding the trap which I had useless, I endeavoured to invent an improved one, of which I now send you a drawing and description, and which I find to answer perfectly.

I am, Sir,

Yours respectfully,

TERRIANDUS.

1



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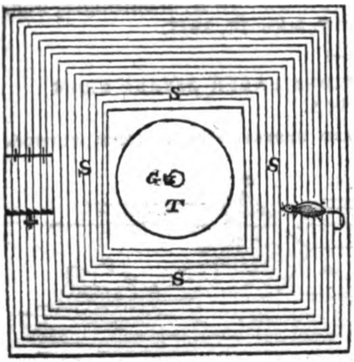

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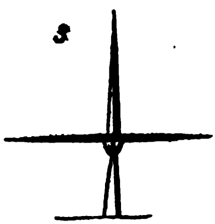

Description of the Drawing.

1, side view; 2, full view; 3, the snare. S S S S are steps up which the rat climbs to get the bait; T is a circular piece of wood, placed on a small iron globe, through which runs a piece of iron, one end for the bait to be placed on, the other to fix in the board. Further explanation is unnecessary.

REVIEW OF PAPERS IN NO. 217, ON THE IMPROVEMENT OF STEAM VESSELS, THE GIGGLESWICK WELL, AND ATMOSPHERIC PRESSURE.

"Semper ego auditor tantum? nunquamne reponam
Vexatus toties rauci Theseide Codri?
JUVENAL, *Sat.* I.

Sir,—Being a great admirer of common sense, and detesting all humbug, especially in those who pretend to be wiser than their fellow-men, and who wish to instruct them by publishing their *sublime** ideas, I beg your permission to act for you occasionally as censor of the press: not in the continental meaning of these words, but that I may expose *printed* ignorance. In pursuance of this design, I beg to offer to your consideration the following remarks on a few papers in your last Number, (No. 217.)

I shall begin with A. B. (page 217), who has favoured us with some "Hints for Improvement of Steam vessels." He, in his first sentence, advises us to "observe minutely the forms of large fish, to see by what means Nature has furnished them with mechanical powers, for cutting their way in the sea." Passing over the bad writing in the sentence, I would ask him of what use this can be, since the fish is entirely immersed in the sea, and the steam vessel has only to skim its surface?† Had he advised us to observe the motions and form of a duck or swan, I could have understood what he intended. In sentence 7th, he says, "The paddles, instead of being at each side, would be at or near the bottom, in front; in the centre, also, (probably); operating in this way like the tail of the fish." I must confess my dulness is too great to allow me to understand this sentence; it is rather too oracular for me. How *paddles in front* are to operate like the *tail* of a fish, I am at a loss to conceive; and if *at or near* the bottom, it seems to me that they would run a *slight* chance of becoming water-logged; still more, if in the centre, as he proposes. He also shows that he is

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* *Sublime*, I suppose, is here taken in the sense of the words from which it is derived, "sublimo," *under the mind.*—*Printer's Devil.*

† Possibly he may have invented a steam vessel to go entirely under water, If so, he ought to have hinted as much.—*Printer's Devil.*

ignorant of the prodigious loss of power, in consequence of the stream caused by the paddles, and through which the ship has to make its way, and which his method of placing the paddles would much increase. In sentence 9th, he says, "The strength also of the stream would be better *supplied*." This may be English and common sense, but it is far beyond me. His proposed alteration of the shape might be beneficial, but not, as he would suggest, from such being the shape of a fish, but from the form of the belly of water-fowl. So much for A. B., whose paper did not deserve so much exposure, had it not been that he lays down the law with all the solemnity of a Dogberry, and with nearly equal wisdom.

Mr. Athelstan, I must allow, set me a *giggling* with his *Giggleswick* theory. He in some degree deserves to be pardoned, since the *Athelstans*, ever since the days of *Ivanhoe*, have been rather remarkable for a natural dulness. The substance of what he says is, "Allow me only whatever I choose to ask, and I'll show you what a clever fellow I am." He first asks us to allow him a cistern inside the hill—granted; next, that this cistern pours part of its contents into its proper channel, but spills part in another direction—good; but where goes this part which is over, and where is the other ebbing and flowing well, which on this hypothesis must exist? Next he says, "Let me have half a dozen fissures in the rock through which the wind blows on the cistern"—better still. But suppose we allow all this, what then? "Why," in that case, he tells us, "the wind will blow on the water and agitate it"—I beg his pardon, "inflate it"—and then it blows into its regular channel, which of course *makes more water* than before. "Hence," continues he, "it *is apparent*." Nay, my good sir, not quite so quick, if you please. Even were I to grant you all the concessions you ask, I am not aware that you could produce all the effects you say; and before I grant them, let me see some reason why I should do so, else I may be stingy, for once, and refuse them. Let me advise you next time, instead of asking such paltry means to produce your effects, to demand at once some young earthquake, or such like probable cause, and, believe me, it will be as soon conceded to you as your present moderate demands.

The next gentleman who comes under review is Mr. J. S., who has favoured us with what he calls a "New Hypothesis of Atmospheric Pressure." As this gentleman threatens us with a repetition of such another enormity as his last, I am the more anxious to say a few words to him, which may, perhaps, be worthy his attention before he intrudes again into the company of what he calls "*scientific minds*." He says, that it is an established notion that the air is heavier in hot sultry weather, than in cold rainy weather. This reminds me of a magician who used to raise shadows in the shape of giants, merely to show what a clever fellow he was in knocking them down again. Whether such an idea ever entered any one's brain or not I cannot tell, as it is the first time I ever heard it. I, for one (and hundreds more with me), have been taught to believe that the rise of the barometer depended on the *accumulation* of air which took place over any particular place, thus causing a greater height of the column of air, and of course a greater weight of matter to press on the mercury in the basin of the barometer. The reasons for this accumulation might easily be given, but are not necessary for an exposure of Mr. J. S. He (if I can understand his meaning, which, I must confess, even after three perusals of his paper, I cannot be sure I do)—he, I say, makes the additional pressure arise from the air being rarefied, and prevented from expanding itself as far as it would wish, by the fluid surrounding our atmosphere, and consequently being compelled to exert a greater pressure on the surfaces around it. To prove this, he only requires to show, first, That the rarefaction of the portion of air

which is heated by the sun's rays, is sufficient to produce so great an effect. Secondly, That the same body of air, which, by its rarefaction, loses a considerable portion of its specific gravity, can, when thus rarefied and in some degree confined, *produce a greater effect by its pressure* than its *weight* alone, when having room enough and of greater specific gravity. Thirdly, That his theory accounts for the fall of the mercury in the barometer before a thunder storm, when the air is generally hotter than at any other time, and when, by his account, it ought to make the mercury rise, as the air will be much more expanded by the heat. Fourthly, That his theory accounts for the barometer in winter standing higher in frosty weather than in rainy weather, when, by his hypothesis, it ought to fall, as the air will be condensed by the cold, of course require less room, and therefore will not press so much on the mercury in the basin. Fifthly—— but I will have mercy on him, and reserve my other questions till he has answered these four. One word more, and I have done. He asserts that "we can produce what nature cannot, or at least allows not," I mean a vacuum. He is surely deceived by the *sound* of words, for any "*sound* philosopher," as he says, knows well that what we, in common *parlance*, call a vacuum in an air pump, or otherwise, is at least as far from a complete vacuum as any of the space which is beyond our atmosphere.

I have already trespassed too far on your time and patience, but have been led on by the desire of exposing these three gentlemen. I promise them that, with your kind permission, I will give them ere long an opportunity of exposing some of *my own hypotheses* and *hints*; till when, I bid them adieu.

I am, Sir,
Yours, &c.
FRANCOIS DU BOIS.

Oct. 22, 1827.

HOW TO FIX BLACK LEAD WRITING.

Black lead writing (see inquiry, p. 148, vol. vii.) may be rendered much more durable by slightly moistening the paper after it has been written on; even breathing on it will be of considerable service.

The durable metallic pencils are a compound of bismuth, lead, and tin; that commonly called fusible alloy, will answer as well as any other. The paper is prepared by rubbing phosphate of lime (white and well sifted bone ashes) into it. Marks made with those pencils on paper so prepared cannot be obliterated. The composition of the fusible alloy is as follows: two parts bismuth, two parts lead, and one part tin.

B.

THORINA NOT A DISTINCT EARTH.

M. Berzelius has ascertained that the substance which he described ten years ago, as a new and distinct *earth*, does not merit that appellation; being merely a sub-phosphate of yttria. We are glad of this correction, and are of opinion, in the present state of chemistry, that the man who strikes an earth or metal off the list, deserves more thanks from the scientific public than he who puts one on.

D.

NOTICES TO CORRESPONDENTS.

Mr. Green's reply to Mr. Harris shall have an early place.

J. O. (Cottage in the Field) is requested to continue his lucubrations. We wish to see at least another paper, before inserting that which he has sent us.

The information wanted by "A Constant Reader," has been already given at page 174, Vol, II.

Communications received from W. Lindsay—A. O.—Aurum—☞—L.—A Country Reader—A First Subscriber—J. Z.—M.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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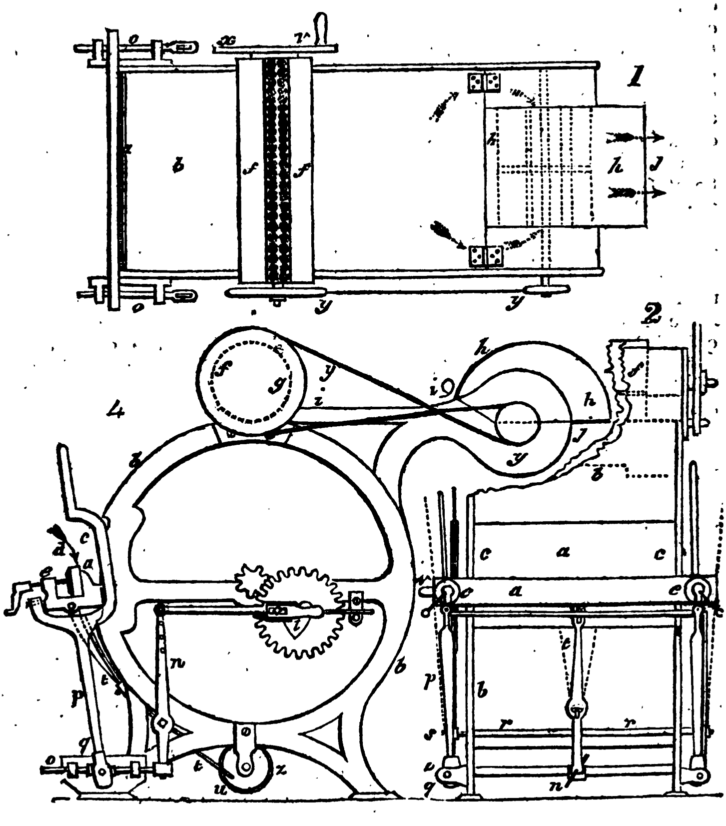
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 220.] SATURDAY, NOVEMBER 10, 1827. [Price 3d.

"The introduction of new inventions seemeth to be the very chief of all human actions. The benefits of new inventions may extend to all mankind universally; but the good of political achievements can respect but some particular cantons of men; these latter do not endure above a few ages—the former for ever. Inventions make all men happy, without either injury or damage to any one single person. Furthermore, new inventions are, as it were, new erections and imitations of God's own works."—BACON.

SAFETY DRY GRINDING MACHINE.



SAFETY DRY GRINDING MACHINE.

In our 154th Number we inserted a letter from a correspondent, representing the injurious effects of the process of dry grinding on the health of cutlers, spindle and fly-makers, wool-combers, and others; and suggesting that Roberts's Safety Hood might be so adapted as to obviate them effectually.

Another correspondent (Medicus) has recently directed our attention to a machine, which we agree with him in thinking is incomparably better suited to the purpose, invented by Robert Cowen, Esq., of Carlisle, and rewarded by the Gold Vulcan Medal of the Society of Arts during the session of 1825-26. It appears from the certificates which accompanied Mr. Cowen's communication to the Society, that his machine has been in use at Carlisle for about seven years, and has proved so perfectly efficacious in conveying away the particles of iron, emery, &c. that used heretofore to be so destructive to the health of the workmen, that they have even ceased to be inconvenienced by them. The Society of Arts describe it, in the Preface to their 44th volume, as "seeming to leave nothing further to be required."

Mr. Cowen's machine is more particularly adapted to the process of dry grinding in cotton mills; but it will be obvious to the reader that the principle of its construction may be applied with facility to every description of dry grinding and ventilation.

Description by the Inventor.

The entire machine is represented in the accompanying drawings, in which fig. 1 is a plan, fig. 2 a side elevation, fig. 3 a section, and fig. 4 a front elevation.

Before a card (one of those employed in carding cotton previous to the process of roving) is ground, it is first laid with the wires downwards in the slits of the cylindrical case *f f*, figs. 1 and 3, where it is cleaned from dust and adhering fibres of cotton, by the action of the cylindrical brush within the case; the air is drawn in at the same time, as represented by the arrow, passes along the trunk *i i*, and thence into the fan-case *h h*, from the mouth of which, *j*, it is discharged into the open air, together with the dust and filaments of cotton.

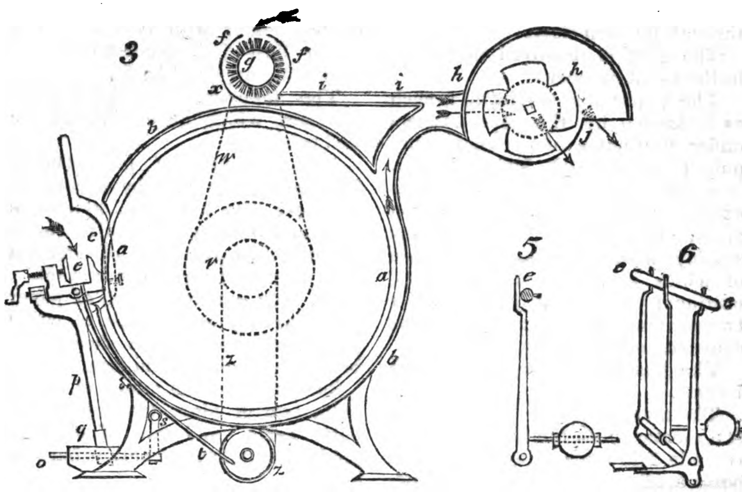
Being thus cleaned, the card is next ground. *a a*, fig. 3, is a drum covered with emery, which forms the grinding cylinder; this is surrounded by a case *b*, having a longitudinal opening *c c*, of the same length as the drum (see fig. 4). Through this opening the card *d* is applied to the grinding cylinder, which, by its revolution, not only sharpens the card-wires, but (assisted by the action of the fan) draws in at the same time a current of air, indicated by the left-hand arrow, figs. 1 and 3: the air passes down between the cylinder and its case; then rising up through the passage or flue, enters the fan-case, and is discharged at *j* into the open air, carrying with it the whole of the dust produced in the grinding.

The moving power is applied to the wheel *v*, fixed on the axis of the grinding cylinder, from which a strap *w*, fig. 3, passes over the wheel *x*, on one end of the axis of the brush *g*; while, on the other end of the axis, a similar wheel is fixed, connected by means of the cord *y*, figs. 1 and 2, with a wheel on the axis of the fan.

The medal of the Society of Arts was given for that part of the machine which has now been described; but as considerable ingenuity is displayed in the mode by which certain motions are given to the card while grinding, an explanation of this part will also, it is is hoped, not be unacceptable to our readers.

It is evident, that if the card, while grinding, were kept in the same position with regard to the drum *a*, its surface would be brought to a concave form, the curvature of which would correspond with that of the drum. But as a card of this figure would answer its intended purpose very imperfectly, it is necessary to have recourse to some means by which the surface may be ground level. This is found to be effected, by giving the card a curvilinear motion, by the union of two movements—one up and down, the other alternate lateral.

At one end of the axis of the grinding cylinder is fixed a pinion, that takes into a toothed wheel, to which is attached the heart *l*, fig. 4: by means of this an alternate lateral motion will be given to the horizontal bar *m*, which motion is conveyed to the bar *o*, through the



connecting lever bar *n*; the fulcrum of this latter is the square end of a horizontal bar *v v*, fig. 4, to the end of which is attached a short bar, which is connected by a joint with the horizontal bar *o*, fig. 3. Thus the two horizontal bars *o o* move equally backwards in the eyes or guides that support them. On these bars rest the two legs of the card-holder; and as this is kept pressed against the grinding cylinder by the action of a spring, it is manifest that the holder, and consequently the card itself, will receive an alternate up and down motion, in proportion as the bars *o o* move backwards and forwards.

Below the machine is the small round plate *u*, fig. 2, which is turned round by means of the strap *z z*, fig. 3, that connects it with the axis *v* of the grinding drum: this plate (see *u*, fig. 4) is placed obliquely, and enters the notched end of the lever bar *t*, fig. 4; this latter therefore receives an alternate lateral motion from the revolution of the plate, which motion is transferred to the card-holder, by slipping the eye at the upper end of the bar over a pin projecting from the cross bar of the card-holder. The spring that keeps the card-holder, and consequently the card, pressed against the grinding drum, is fixed to the fore part of lever bar *t*, and pressed by its free end on the back of the card *d*.

Instead of the spring, an adjustable lever, fig. 5, may be used, or the apparatus, fig. 6, which differs from the preceding in having a treadle and two cranked arms, for the convenience of withdrawing the holder, in order to take out or put in a card.

ARTIFICIAL SLATES.

There have been for some years imported into Russia, a species of artificial slates, manufactured by a person named Alfuid Faxe, of Carlscroon. These substances attracted the notice of several scientific men. M. Géorgi was instructed by the Academy of St. Petersburgh to make an analysis of them, by which means he discovered their composition. They are a most invaluable substitute for slates; as they are much lighter, impenetrable by water, and incombustible. The following processes for manufacturing them, afforded the best results to M. Géorgi.

The substances employed were, 1st. A bolar earth, white, red, or ferruginous, according to circumstances. 2d. Chalk, or carbonate of lime. 3d. Strong or English glue. 4th. The pulp of paper. 5th. Linseed oil.

The bolar earth and the carbonate of lime are reduced to powder

separately, in a mortar, and passed through a silken sieve.

The glue is dissolved in water, in the usual manner.

The paper pulp employed is such as is known by the paper-makers under the name of common paper pulp (*papier bulle*). This is steeped in water, and the water afterwards extracted from it by means of a press. Instead of this pulp, we may employ with advantage the waste of white paper, or book-binders' cuttings; these must be boiled for twenty-four hours, and the water squeezed out by means of a press.

The linseed oil employed must be raw.

The mass of paper being mixed in a mortar, with the dissolved glue, is made into a paste, by adding the bolar earth and carbonate of lime. The whole being well beaten together in the mortar, the linseed oil is poured in from time to time, as fast as it can imbibe it. They then take a quantity of this mixture, and spread it with a spatula on a plank or board furnished with a ledge or border, to determine the thickness of the layer;—before this is laid on, however, the plank is covered with a leaf of common paper. They then place upon this mixture another leaf of paper, on which they lay another plank, and reverse the whole: they then lift off the bordered plank, together with the first sheet of paper. After this operation, they again reverse the *stone paper*, and lay it upon a plank strewed over with very fine sand by means of a sieve: they then remove the second plank, and the second sheet of paper; leaving the sheet of composition to dry.

These sheets neither crack nor break in drying; but they are liable to become twisted out of shape, and they are seldom smooth, or without lumps on their surface. To remedy these inconveniences, they are passed between the two cylinders of a flatting-mill, which perfectly unites and gives them firmness: they are then submitted for some time to the action of a press, which makes them perfectly straight and even. And, lastly, the two surfaces of each sheet are coated, either with boiled linseed oil, or linseed oil rendered drying by a little oxyde of lead.

The following are those compositions which have afforded the best results:—

1st. One part of pulp (made from old paper and book-binders' cuttings), half a part of glue, one part of chalk, two of bolar earth, and one part of linseed oil—form a thin, hard, and very smooth sheet.

2d. One part and a half of paper pulp, one of glue, and one of white bolar earth—produce a sheet very beautiful, hard, and uniform.

3d. One part and a half of paper pulp, two of glue, two of white bolar earth, and two of chalk—produce a uniform sheet, as hard as ivory.

4th. With one part of paper pulp, one of glue, three of white bolar earth, and one of linseed oil, we obtain a beautiful sheet, which has the property of being elastic.

5th. One part of paper pulp, half a part of glue, three parts of white bolar earth, one of chalk, and one and a half of linseed oil—form a sheet infinitely superior to that obtained by the process No. 4. This substance has also the property of retaining whatever other shape may be given to it. A few grains of Prussian blue give it a bluish-green tint.

We may substitute with advantage, in place of the carbonate of lime and the bolar earth (of which we have above spoken), the *carbonated pulverulent lime*, which Fabbreni discovered in Tuscany; of which he manufactured his floating bricks, and to which he gave the name of *fossil farina*. In the year 1800, Faujas discovered, in the department of Ardèche, four leagues distant from the banks of the Rhone, a considerable bed of this earth, in a place readily accessible. This substance is not rare. Brogniart assures us that it is found, in a layer of a centimetre in thickness, on the lower or lateral surfaces of beds of coarse carbonate of lime. It is frequently found in the environs of Paris, but more par-

ticularly in the quarries of Nantz. This earth is white, as light as cotton, and is reduced to powder by the least pressure.

The various experiments made on these sheets of stone paper, or artificial slates, have proved:—1st. That by a continued steeping in cold water for four months successively, they did not in the least change, nor increase in weight. 2dly. That on being exposed to a violent heat for five minutes, they were scarcely altered in form; but were converted into black and very hard plates: they merely appeared blackened, and somewhat scorched.

They constructed a house of wood at Carlscroon, which was entirely covered and lined with these articles; they then filled it with combustibles, and set fire to it: the house resisted the action of the flames.—The experiment was repeated at Berlin, and with the same success.

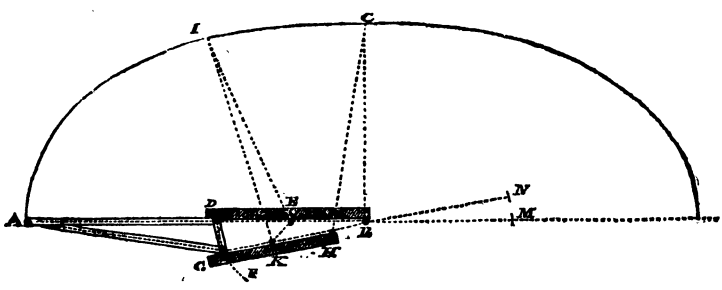
The materials fit for making this stone paper are to be found in all parts of the globe. The process is simple, and it requires only very facile manipulations: it may be used, with economy, for covering houses, instead of slates; and for which purpose its lightness renders it far preferable. In this case, it is secured, in large leaves, by copper nails, and the joints filled with cement. The whole being coated with an oil-colour, forms the lightest covering, and one the least penetrable by water.

The cement recommended for filling the joints between these sheets after being nailed on, is composed of linseed oil rendered drying, white lead, and chalk, intimately mixed, and used in a nearly fluid state, in order that the composition may the better insinuate itself amongst the joints and interstices, and cover the heads of the nails.

SEPTENARY SYSTEM OF GENERATING LINES.

Sir,—I have stated in your Number 206 (vol. viii. p. 38), that the directing right lines of an elliptic apparatus may make any angle with each other; but, perhaps, an example will serve better to impress that fact, as well as its utility, on the minds of your readers.

Suppose, then, that half of one of the arches of Waterloo Bridge is required to be described full size. Let the half span A B be 60 feet, and the rise B C 28 feet: the difference between these dimensions is 32 feet = D B; the half of which is 16 feet = D E: with this as a



radius, and centre E, describe the arc D F; then, with any convenient length for the distance between the poles (here 5 feet is considered abundantly sufficient), set it off from D to G on the arc D F, and from G draw the line G B. Let the triangular frame A D G be made of light strips of wood; at D and G, fix to this frame two round pins or poles, and at A fix the pencil or describing point. Fix the straight edges E and K parallel to the lines D B and G B, but at half the diameter of the poles from those lines. Then, if the pole D be moved

along the edge of the ruler E, while the pole G is kept against the edge of the ruler K, the describing point A will draw the half of the arch A I C. The dotted lines show the triangular frame, with the poles and describing point in different positions.

By the common way of drawing this ellipse with a trammel, the trammel-rod, or that which carries the describing point and poles, would be required to be something more than 60 feet long; but, by the above method, it is not much more than 28 feet—or less than one half. Besides this very great reduction in the length, the triangular frame carries the poles and describing point with a degree of steadiness of which the common method is utterly incapable without vastly increasing its weight, and consequently greatly increasing the difficulty of its management.

If the ruler K had been fixed above the ruler E, making the same angle with it, it must then have been as much longer than that ruler as it is in the annexed diagram shown shorter. This would be the case if both rulers were continued to L and M, the pole at B moving to M, and the pole at H to N; and then the other half of the arch might by that means be drawn. If both rulers were to make the same angle with the line A B—that is, the one above and the other as much below that line—the rulers must then be of equal lengths.

It will appear manifest from the drawing, that, by placing short rulers at the proper angle and distance from each other, any small portion of this arch may be described in any room or passage a little more than 28 feet long.

If the rulers were placed between the poles in the above example, the appearance would be still more compact.

In a former number of your work, I had occasion to notice the improper use Mr. Alderson made of information I gave to him; and I have now to complain of Mr. Peter H. Desvignes, architect (late pupil to Wm. Atkinson, Esq., architect to the Ordnance Department, M. G. S., F. H. S., &c.)

About the beginning of the present year I showed Mr. Desvignes, as a friend, my instruments for drawing curves, and I explained to him my system, and also *informed him that I intended to publish an instrument for drawing the Ionic volutes.*

Friend-like, Mr. Desvignes set about making an instrument which he calls a speiragraph; and in a notice of his intention to publish it, he sets it forth with the above recommendation as *A New (long-sought for) Instrument*, affecting ignorance of my instruments, system, and intentions; and, in all probability, I should have known nothing of his proceedings, had I not accidentally been informed of it by Mr. Inwood.

That public spirit which you advocate, and which would willingly do justice to original inventors who are now no more, will, I trust, not fail to discriminate, while full proof can be obtained, to whom, in this instance, the credit of originality belongs.

One of my instruments for drawing spirals, the principles of which have repeatedly been publicly explained, I have lately in its application much improved. This instrument describes the exact Greek volute, which is a spiral of so peculiar a character, (and I believe there are only *three* principles by which it can be generated, viz. by the second, third, and seventh divisions of my system,) that to me it appears to amount almost to a demonstration that the ancients must have produced it by one of these methods.

The following are the bases of several other methods I have used for describing spirals:—

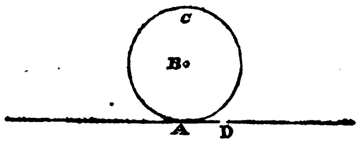
First, The unwinding of a string from a cylinder.

Second, The unwinding of a string from a cone, or from the groove of a fusee, either straight or curved.

Third, The evolving of either a straight or curved ruler from a circular wheel, or from bases either elliptical or of any other form; and the evolving ruler regulating the motion of a plane.

Fourth, By a combination of these principles with levers, with each other, and with the several motions in the septenary system.

By any motion under the two last general descriptions, the pencil may be placed so as to draw lines of different characters. Thus, for example, if the motion of a surface be regulated by the evolving of a right line from a circular base.



If the pencil be placed any way on the right line, as at A, it will describe an evolute, which is an infinite cuspidated line; for, the right line may be supposed to evolve first one way and then the other; and where the pencil touches the circumference of the circle or base, the cusp is formed.

In this case, the line of the cusps is a right line.

If the pencil be placed at B or C, or at any other distance on that side of the right line, and the right line be evolved both ways, it will describe a nodated line. If the pencil be placed at the distance C, and the right line evolved only one way, the spiral line, thus formed, would join a circle whose centre is B, and of the same radius as the base, at the same tangent.

If the pencil be placed at B, the spiral will have the appearance of beginning from a point or centre. If the pencil be placed on the other side of the right line, as at D, the line described will be inflected.

I have made this statement respecting different modes of generating spirals, that I may be able to show, when Mr. Desvignes' instrument makes its appearance, how far he has availed himself of my communications.

As Mr. Desvignes is a draughtsman of acknowledged merit, the fact of his resorting to instrumental drawing, although under such mean attendant circumstances, I hope will contribute to draw the attention of youth generally to the practice; for in no other way can they attain in architecture the eminence of the ancients, whom to copy exactly is considered (although in all cases, perhaps, not justly) the nearest approximation to perfection.

Instrumental music has, doubtless, greatly contributed to improve vocal; and it is considered instrumental drawing will have as great a tendency to improve architecture.

I am, Sir,

Yours, &c.

J. JOPLING.

24, Somerset-street,
Portman-square.

USE OF SOAPSTONE IN DIMINISHING THE FRICTION OF MACHINERY.

It has been found, in American manufactories, that soapstone, besides answering much better than any other substance that can be procured for the purpose of diminishing the friction of machinery, saves a great deal of trouble and expense. It is first thoroughly pulverized, and then mixed with oil, tallow, lard, or tar, whichever may be the best adapted to the use for which it is designed. It is, of course, important to procure it free from *grit*; and it can be purified, in a great degree, by mixing the powder with oil, and diluting it after it has stood a few minutes. The heavier particles will form a sediment to be rejected. It may be used on all kinds of machinery where it is necessary to apply any unctuous substance to diminish friction; and it is said to be an excellent substitute for the usual composition applied to carriage wheels. Some idea of the value of soapstone, in this use of it, may be formed from the following fact, communicated by D. Moody, Esq., the superintendent of the tan works on the mill dam near Boston, (United States). Connected with the rolling machinery of that establishment there is a horizontal balance-wheel, weighing *fourteen tons*, which runs on a step of five inches diameter, and makes from seventy-

five to a hundred and twenty-five revolutions in a minute. About a hundred tons of iron are rolled in this machine in a month; yet the wheel has sometimes been used from three to five weeks, without inconvenience, before the soapstone has been renewed.—*Abridged from the American Journal of Science.*

The soapstone here alluded to, is what is scientifically known by the name of *steatite.* It derives its more common appellation from feeling soapy to the touch. Its component parts are, silica, magnesia, oxide of iron, and water. In America it is more plentiful than with us; but a sufficiency of it for the use of machinery may, we believe, be obtained from Cornwall.—*Edit. Mech. Mag.*

ENGINE EXTRAORDINARY, ANNOUNCED IN AMERICA.

A correspondent of the American Mechanics' Magazine, gives the following wonderful account of a new engine, which he says will shortly be produced at New York." It is free from the heat and danger accompanying highly elastic steam, as in Perkins's engine, and from the tremulous motion and rumbling noise of Brown's. It will occupy little space, probably less than that of Perkins's, and is so silent that it will scarcely be heard. There is no fire, no boiling water, no burning of gas. It is light, simple, and efficient; dissipating, at first sight, all those apprehensions which all other engines are calculated to excite. It can be regulated so as to work with a pressure of from one to six hundred pounds upon the square inch, with a very moderate strain on any given part of the machinery."

The inventor pledges himself, that an engine of sixty horse power shall be kept at work night and day, for one month, at a cost not exceeding ten dollars!!!

GRAMMATICAL ANOMALIES.

Sir,—I take the liberty of submitting to your notice a few observations respecting collective nouns; which, if you think proper, I would have inserted in the Mechanics' Magazine.

The nature of collective nouns is to communicate an idea that the subject spoken of contains several parts; and these parts must each be of the same description or quality. A *parliament* is a collection of men, all of the same description; but when we communicate an idea that is compounded of many kinds of parts, each part is essential to the being of the subject, and is a proper or common noun. The word *balance* is a common noun, though it is often used as a collective one: it has two arms, I will allow, but which conjoinedly are essential to the existence of the subject; nor is the subject a balance when deprived of either arm; therefore we cannot consider them as a collection of independent things, nor, in speaking thereof, a collective noun. Again, the word *pair* means a collection of two things; and a pair of shoes, two shoes: but a pair of bellows is improper; for if one be divided, each part is not a bellows, but the essential difference of the subject; therefore, we cannot properly term the subject two, or a pair of bellows, though it is so considered. Many instances might be adduced of such improprieties.

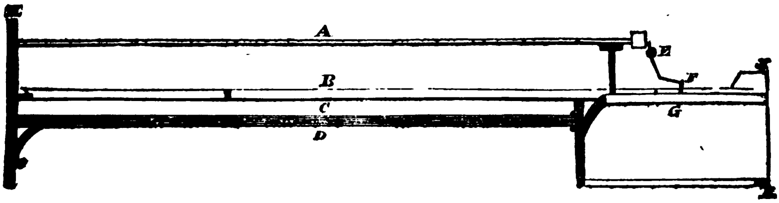
Yours respectfully,
GEORGE NEWCOMB.

HYGROMETRIC PROPERTY OF SULPHURIC ACID.

The quantity of water that sulphuric acid, sp. gr. 1·840, is capable of absorbing from an atmosphere saturated with vapour, has lately been determined, by an exposure of 50 grains of acid of the above strength to such an atmosphere. In the course of four months, it gained 423·2 grains of water—considerably more than eight times its original weight—its sp. gr. being diminished to 1·0706.

D.

COMPENSATING PIANO-FORTE.



Sir,—If the following plan for a compensating piano-forte should be thought worthy of a place in your highly valuable Magazine, you will oblige me by inserting it.

The plan is for the purpose of keeping the instrument in tune. I would not wish to be understood that I think this plan would keep the instrument in tune for ever: it is only intended to make up, in a great degree, what the instrument loses from the action of heat upon the wires. I call it *compensating*, for the same reason that the most approved pendulums for clocks are called compensating pendulums; though we well know that they do not altogether make amends for the expansion or contraction.

The prefixed drawing is a section of a horizontal grand piano-forte, represented with the proposed improvement. A is a rod or tube (perhaps the latter would be best), of the same metal as the wire B. Now, it must be first ascertained what proportion the expansion of the tube (lengthwise) bears to the expansion of the wire; when, this being determined, we must construct a lever of unequal arms, so that the short arm shall bear the same proportion to the long one, as the expansion of the tube bears to that of the wire. This lever must be placed at that end of the tube which is near the wrest-pin F, with its short arm touching the end of the tube; at the extremity of the long arm a wire must be fastened, which must likewise be wound round the pin, in a contrary direction to the wire B. Then, as the tube and wire expand, the tube will push forward the short arm of the lever, and consequently draw back the long one; which having a wire fixed to its extremity, and also wound round the wrest-pin, in drawing backwards, must turn the pin; and as the wire B is wound in a contrary direction to the other wire, it must be tightened as the pin moves round.

This shows the action of it, as regards one wire only: in a subsequent letter, I will show its application to the whole instrument.

Yours, &c.
A Member of the London Mechanics' Institution.

WRIGHT'S NEW PATENT CRANE.

On Thursday last, (1st November), we attended, by invitation, at the West India Docks, to witness a trial of work between a new crane, invented by Mr. L. W. Wright, engineer, and one of the common cranes heretofore in use. The Directors of that establishment were themselves already so well satisfied of its superiority, that, though Mr. Wright only entered his patent in August last, and has yet his Specification to enrol, we were shown no less than eighteen cranes, which he had, within this short interval, furnished to their order. Some doubts had, however, been expressed by others, as to the saving which the new machine effected; and the object of the present comparative trial was to set all such doubts at rest, by showing how much more labour it could do within a given time, than the best of the common cranes, worked in the best manner.

The result of this trial was such as fully to justify the favourable opinion on which the West India Directors acted so liberally; although the manner in which that trial was made was not, we must

say, at all calculated to bring the merits of the new crane into a fair point of view.

Of course, the simplest, as well as most satisfactory mode of trying the comparative powers of the old and new cranes, would have been to work one of each by *the same number of men* of equal strength, and equally accustomed to this sort of employment, in raising the same weight during the same space of time. Instead of this, the trial was between one of Mr. Wright's cranes, worked by *three* men, and one of the old cranes, worked by *six;* by adopting which proportion, it seemed to be assumed beforehand, that the former could do double the greatest work of the latter. Now, the utmost saving of labour which we were informed the West India Directors reckoned on realizing, by the introduction of Mr. Wright's invention, was *one-third;* nor did the inventor himself profess to us to effect more. The eighteen new cranes already in use at the Docks, have accordingly had only four men put on each, instead of six, the number required for the common cranes.

But whether the expected saving was one-half or one-third, a trial with the same number of men at each crane would have answered equally well to ascertain the actual difference; while any trial by unequal numbers could only serve to give a needless complexity to the results.

In another point of view, there was a still more remarkable disparity in the conditions of this trial. The six men employed to work the common crane were picked men—the stoutest and ablest of several hundreds constantly employed at the Docks in working cranes, for eight hours a-day; while the three who had been stumbled upon to show the power of Mr. Wright's crane, were raw bricklayers' labourers; stout men certainly, but, according to their own admissions, not at all accustomed to this sort of employment. It is scarcely necessary to observe, that there is a tact in this as well as in other bodily feats, which is only to be acquired by considerable experience; and that men accustomed to apply their bodily strength in one particular way, become stronger as to that single application of it, than men of far greater strength in regard to every thing else.

Having, as in fairness bound, stated these exceptions to the mode of trial adopted on this occasion, we shall now proceed to mention its results.

The weight raised by each crane and each set of men, was 18 cwt.; and the space through which it was raised each time 30 feet.

The six men, with the common crane, worked 2 hours 23 minutes and 36 seconds, and hoisted the weight 81 times; being on an average once in every minute 46 seconds and four-tenths of a second.

The three men with Mr. Wright's crane, worked only 2 hours 10 minutes and 30 seconds (an accidental fracture of part of his machine causing it to stop sooner than the other), and hoisted the weight 46 times, being on an average once in every two minutes 50 seconds and two-tenths of a second.

To reduce the work done by the two sets of men to equal terms of comparison, we must

First equalize the time occupied:

	h.	m.	sec.
The six men worked .	2	23	36
The three . . .	2	10	30
Difference . .		13	6

So that we must deduct from the total number of hoists (81) made by the six men, the number of hoists in 13 minutes 6 seconds, which, at one hoist per minute 46 seconds and four-tenths, is nearly 8; say, however, only 7; this reduces the actual number of hoists made by the six men in the same space of time to 74.

Secondly, We must equalize the manual power employed; to do which we must take half only of the work done by the six men, to represent what three would have done in the same time. Hence $\frac{74}{2}$ 37.

We have, then, for the work done

in 2 hours 10 minutes 30 seconds, by three men, with the old crane 37
By three men, in the same time, with Mr. Wright's crane . 46

Gain by the new crane . 9

This result exhibits an advantage of about one-fourth only over the old crane; but we are perfectly satisfied, that had Mr. Wright's machine been worked by men as accustomed to this sort of labour, and as earnestly bent on victory as their opponents, (excited, as the latter were, to unwonted vigour, by a desire of disparaging an invention that has for its object to lessen the demand for their services), the expected superiority of one-third would have been fully realized. Mr. Wright's men exhibited, at the conclusion of their work, scarcely any signs of exhaustion; while, of their opponents, one was sick and faint, a second was bleeding at the mouth, and a third bleeding at the nose. So extraordinary was the exertion made by the poor fellows who plied the common crane, that though their ordinary labour has seldom averaged more than twelve hoists, thirty feet high, per hour (for eight hours' continuance), they performed, on this occasion, above three times that number.

If we contrast the work done by Mr. Wright's crane, at this trial, with what has been *ordinarily* done with the common crane, it will exhibit a superiority of far more than one-third. For, at twelve hoists by six men per hour, we have, in 2 hours 10 minutes 30 seconds, but 26 hoists, or 13 by three men; while with Mr. Wright's crane, three men performed, in the same space, forty-six hoists, or about three and a half times as much. Nor did it appear to us, that three men habituated to turning a winch could have any difficulty in working Mr. Wright's crane, at the same rate as that which we witnessed, for a long day's continuance.

When the common crane is worked at a rate of more than twelve or fifteen hoists of eighteen hundred weight an hour through a space of 30 feet, it is only by extraordinary exertion; while the superior power of Mr. Wright's crane is gained with little if any extra exertion. So small is the stress on the hand with this machine, that we saw a weight of ten pounds, placed on the winch-handle, balance of itself, the eighteen hundred weight attached to the chain; and we saw also Mr. Wright raise, by his single power, the whole eighteen hundred weight, slowly, but yet with apparent ease;—a feat which we suspect very few men could accomplish with the common crane.

The capabilities of Mr. Wright's machine may be yet further illustrated, by another sort of calculation. According to writers on mechanics, a man, by turning a roller with a handle, can, for a continuance of six hours at a time, only raise 550 lbs. weight through 10 feet in a minute; and we have seen, that with all the additional assistance afforded by the wheels and pinions of the common crane, it has not been *the practice* for the workmen at these Docks to realize much more than double that rate. For, 550 lbs. raised 10 feet per minute, is in the proportion of 183⅓ lbs. raised 30 feet in the same space of time; and 18 cwt. or 2016 lbs. raised 12 times an hour, to the height of 30 feet, is the same as 2016 lbs. raised 6 feet in a minute; which 2016 divided by 6, the number of men employed, gives only 336 lbs. for each. But Mr. Wright's machine, as tried on the present occasion, raised 18 cwt. or 2016 lbs. through 30 feet in 2 minutes 50 seconds 2-10ths, being in the proportion of about 2134 lbs. raised through 10 feet in a minute. Dividing, therefore, 2134 lbs. by 3, the number of men employed, we have 701 lbs. for the weight raised by each man 10 feet per minute; *being nearly four times more than what a man can effect by a simple roller and handle, and twice as much as it has been customary to accomplish with the common crane.**

* It may be proper to observe, that the preceding calculations are but

Besides being thus superior in power, and easy to work, Mr. Wright's crane possesses two additional advantages. It can be put in and out of gear by a mere push of the hand; and, in lowering a weight, the men have so complete a command over the machine, that they can stop it at any point they please.

As Mr. Wright has not yet enrolled his specification, and the machine may possibly undergo some alterations and improvements previous to his doing so, we think it would not be fair to him, at present, to describe in detail the mechanism by which the remarkable results we witnessed have been obtained. We may state, however, generally, that the machine is constructed on the principle of superseding the use of wheels and pinions by means of levers and friction rollers; and that, however paradoxical it may seem to dogmatizers in science, both power and velocity are gained by the new combination. As soon as the ingenious inventor has lodged his specification and drawings at the Patent Office, we shall lay copies of both before our readers.

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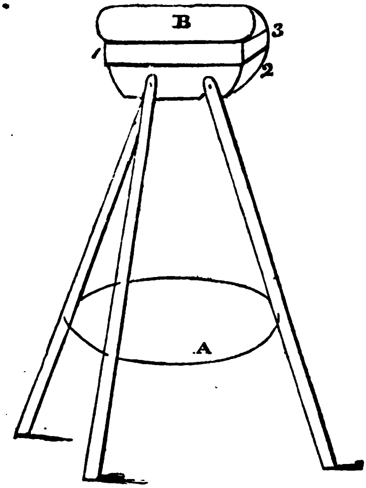
general approximations to the truth; sufficient only for the purpose of comparison. The rate, for example, at which *two* men can raise a weight, is more than exactly double what one man can raise; from the time also stated to be occupied in raising each weight, some deduction must be made for the lowering of the chain after each hoist.

PORTABLE SEAT FOR PUBLIC PLACES.

Sir,—Allow me to describe in your pages an upright seat, which will be found of interest to those who attend the public Courts, where, as in the case of our Crown and Shire Halls at Lancaster, there is generally a very limited accommodation for the public. At the recent trial at Lancaster, respecting the Mersey and Irwell Navigation Company, which took up two days, the Court was crowded almost to suffocation; and the seat I am now to describe, I had prepared expressly for that occasion. Instead of standing the whole time, as hundreds of others did, I sat nearly as much at my ease as if I had been at my own fire-side.



The seat, as represented in the above drawing, is two feet eight inches high, so that, while resting on it, my feet just touch the floor, and I am all but in an upright position. The seat legs are made only to expand on the same space as the person would occupy if not using such a seat.

The cord A is for the purpose of preventing the feet from expanding too far, and serves also to rest the feet on occasionally.

The legs of the seat, when lifted up, close together in the same manner as a telescope-stand, or the sight and level stands of land measurers. The size of the top from 1 to 2, is seven inches, and from 2 to 3, is three inches. B is stuffed with hair about three inches thick, to make it easy, as the person sits on it as on a saddle. The whole comes within a very small compass, and may be carried under the arm with as little trouble as an umbrella.

I remain, yours,
M. SAUL.

Sulyard-street, Lancaster,
Oct. 6, 1827.

REPLY OF A. B. TO FRANCOIS DU BOIS.

Sir,—Your choleric correspondent, Francois Du Bois, feels sore, and is in so great a hurry to censure others, that he lays himself open to reproof for his evident want of temper and good manners, as well as unfairness in misquoting, misstating, and misapplying, what he takes on him to condemn. A. B. presumed merely to offer hints to the many ingenious mechanics who read and contribute to your useful pages. But how could this apply to Francois Du Bois? Did he quote "Juvenal" to show that he was not a *mechanic?* This was not needed; his English authority was quite sufficient. The illiberality of this would-be critic seems odd enough on a subject so little likely to require it, unless, indeed, the gentleman be a builder of steam vessels, and likewise a blunderer. The only quotation wherein he has been apparently successful is evidently a misprint. Thus "The strength also of the steam would be better '*supplied*,' instead of '*applied*.'" The "Printer's Devil" would have put him right here, if he had stated his difficulty to him.

Some of those "hints" which Francois Du Bois has honoured with his derision, have been acted upon and found correct; others, it is believed, will be found so when fairly tried. Has Francois Du Bois never seen a whale or a porpoise swim? The latter comes sometimes even above bridge, and is generally half out of water; so also the whale. But A. B.'s hint was to mark the ease and speed with which they cut their way through the water from shape and mechanical power merely, and to invite attention thereto. Some of your more ingenious correspondents have had reference to parts of fishes with evident advantage—a great encouragement to pursue the same course.

Nov. 5, 1827. A. B.

RECANTATION OF G. S.

(Continued.)

Sir,—Having in my last communication shown some advantages which the White Sheep System has over that of the Black Sheep, particularly in the case of falling bodies,* (No. 217,) I shall now proceed to make a few remarks on Mr. Henry Ottley's second article (No. 215). Before doing so, however, I must first, in justice to myself, beg leave to state that, on this particular subject, I find I have still some misgivings; or, in other words, a few black spots still remain on my fleecy covering. In the article above alluded to, Mr. H— O—y says, he can see nothing analogous between the three roots of the equation $x^3=8$ and the multiplication of $\sqrt{-a}$ by $\sqrt{-b}$. The three roots of this equation, Euler finds to be 2, $-1+\sqrt{-3}$ and $-1-\sqrt{-3}$; and in order to prove that these roots are correct, he (Euler) involves the two last expressions to the third power, and in both cases the results or cubes he shows to be 8, which they ought to be by the condition of the given equation. Now, in the course of the operation, we have to multiply $\sqrt{-3}$ by $\sqrt{-3}$, (No. 214, page 173). Therefore, with all due deference to the superior attainments of my noble commander, I am rather of *opinion* that there is a *striking* analogy between the multiplication of $\sqrt{-a}$ by $\sqrt{-b}$, and that of $\sqrt{-3}$ by $\sqrt{-3}$. For when $a=b$, and each $=3$, the two expressions are identical. But, in justice to Mr. H— O—y, I must state, for the information of all the readers of the Mechanics' Magazine, that Euler was decidedly a *Black Sheep*. Mr. William Russell has proved, in two different ways, that $\sqrt{-a}\times\sqrt{-b}=-\sqrt{ab}$, (No. 210). This first proof he deduces by the method *ex. absurdo;* that is, he proves that $\sqrt{-a}\times\sqrt{b}$, being supposed $=+\sqrt{ab}$, involves a contradiction, or leads to an absurd conclusion. Euclid himself has often recourse to a similar mode of deducing the truth, (but Euclid may be styled the father of the Black Sheep). Mr. Russell's second demonstration is direct and ingenious; he has proved that if this part of the New

* Mr. H— O—y, it seems, from his last reply, has not yet had enough. I shall certainly return again to the subject, and put him in possession of some information which he seems to be much in want of. But, in the mean time, I beg leave to go on in my own way.

Light System be true, and any two quantities whatever be multiplied together, the product must have the double sign $\underline{\times}$! Well, be this as it may, one thing is certain, and that is, if Mr. H— O—y is right, all the writers on algebra, from the days of Diophantus to the present time, have been a set of mere drivellers; none of them could have had more than one eye, as they have been only able to perceive one half of the truth.

But now, Mr. H— O—y, let us come to an issue at once. Cube the expression $-1+\sqrt{-3}$, and, from your supposition that $\sqrt{-3} \times \sqrt{-3} = +3$, prove that $(-1+\sqrt{-3})^3 = 8$. But I beg your pardon; I forgot that you have already stated, that you cannot see any connexion between the roots of the equation $x^3 = 8$ and the multiplication of $\sqrt{-3}$ by $\sqrt{-3}$.*

Well, then, suppose we take the equation $x^2-20x+120=0$. Now, whatever the two roots of this equation may be, either of these values substituted for x must make the equation $x^2-20x+120=0$. The two roots of this equation are $10 \pm \sqrt{-20}$; and suppose that $x = 10+\sqrt{-20}$; then, according to Old Light System, $x^2-20x+120=0=100+20\sqrt{-20}-20-200-20\sqrt{-20}+120=0$. But according to the New Light System, $x^2-20x+120=100+20\sqrt{-20}+20-200-20\sqrt{-20}+120=40$; hence $40=0$!!! Now, Mr. H— O—y, if you can prove, without any tergiversation, that $40=0$, or, what is the same thing, that $80=40$, or $2=1$, the New Light System must be true: but if you fail in this, mark the consequence—the Black Sheep will pack us all off to Jericho, there to tarry until our beards are grown.

I am, Mr. Editor,
Yours with respect,
G. S.

LONDON MECHANICS' INSTITUTON.

NO. XIII.

Lectures.

Wednesday, Oct. 3. Mr. Chapman on Imagination; to be continued.

Friday, Oct. 5. Professor Millington on Hydrostatics; Principles of Specific Gravity; Hydrostatic Balance; Nicholson's and Coates's Instruments; Sykes' and Clarke's Hydrometers; Method of the Negroes in obtaining Specific Gravity; Conclusion.

Wednesday, Oct. 10. Mr. Wallis commenced his lectures on Astronomy.

Friday, Oct. 12. Mr. Wallis.

Wednesday, Oct. 17. Mr. Wallis.

Friday, Oct. 19. Mr. Wallis.

Wednesday. Oct. 24. Mr. Wallis.

Friday, Oct. 26. Mr. Wallis.

Wednesday, Oct. 31. Mr. Wallis.

In consequence of the large space which Mr. Wallis's apparatus occupies, and of the attractive splendour of his illustrations, he is obliged to repeat on Friday the discourse of Wednesday, in order that every member may have an opportunity of hearing him. It must be confessed, however, that the general interests of the Institution would be better consulted, by the introduction of some variety. Mr. Wallis's course has been often repeated, and there are many members to whom it can now present nothing new.

We understand that Professor Millington only waits for an opening to resume his highly valuable lectures. It is a pity he should *wait*.

Dr. Birkbeck has informed the members that a memorial has been presented to the Committee, requesting that a Latin class might be formed, without any expense to the Institution: the plan, he observed, had his full approbation, and it remained with the members to receive or reject it.

The Committee have at length completed their arrangements for the opening of a workshop for the use of the members. Beautiful lathes and tools of every description, are now at the service of any one who is disposed to work for the benefit of the Institution. The Committee deserve the thanks of the members for the excellent manner in which the shops are fitted up.

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Sir,—I have perused with pleasure the periodical reports of your corres-

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* This was rather an unfortunate remark of Mr. H— O—y; for the black fleeced gentry will sneer, and say, "*He* pretend to introduce innovations in algebra! Why, he does not know how an equation is formed!"

pondent ☞, of the proceedings of the London Mechanics' Institution, and perfectly agree with him as to the necessity of a Special General Meeting being called; both for the purpose of giving the members an opportunity of inquiring into the cause of the roof being in its present disgraceful state, and also for the purpose of enabling a certain dignitary, who has the credit of constructing the said roof, to explain why he has thought proper to absent himself from our meetings ever since the work of his hands threatened to fall about our ears. If free from blame, one would have thought he would have gladly courted every opportunity of explanation.

I embrace this opportunity to call your attention, as well as that of the members, to the proposal of Mr. Lane, that a day-school should be established at the Institute. The plan, I think, deserves the serious attention of the Committee, as being (should it succeed, which I have no doubt it would) one of the most independent means of recruiting our treasury, and enabling the Institution to liquidate the debt under which it labours.

I am,
Yours, &c.
J. Z. M.

CASTING MEDALLIONS.

Sir,—In your valuable Magazine, vol. i. page 446, an Old Caster has given what he calls the English method of casting medallions. This I have tried, but cannot obtain a cast that is by any means equal to the original, and have therefore abandoned my labours as useless. J. D. S., in vol. ii. page 29, gives another method; but, as far as I can comprehend his meaning, it appears to be attended with much trouble and expense. The mould I can get in the most perfect manner, and have taken casts from it equal to the original; but have never been able to make one in metal that is perfect. Some of your ingenious correspondents may, probably, give some further explanation, or may inform me where I can see the process in its actual operation. There is another obstacle which I have never been able to overcome, namely, that of amalgamating the metal. Does it require a high temperature, and where can the metal be procured (I mean type-metal)?

I am, Sir,
Yours, &c.
A SUBSCRIBER.

Mile-End Old Town,
Oct. 26, 1827.

METHOD OF BLEACHING SHELL OR SEED LAC.

It has been a great desideratum among artists to render shell lac colourless, as, with the exception of its dark brown hue, it possesses all the properties essential to a good spirit varnish in a higher degree than any of the other resins. A premium of a gold medal, or thirty guineas, "For a varnish made from shell or seed lac, equally hard, and as fit for use in the arts, as that at present prepared from the above substance, but deprived of its colouring matter," has long been, and is still offered, by the Society of Arts. These ends, however, may now be considered as perfectly attained by a process given by Dr. Hare, in the American Mechanics' Magazine for August last. It seems to leave nothing to desire, excepting, perhaps, on the score of economy.

Dr. Hare's method is as follows:—Dissolve, in an iron kettle, one part of pearlash in about eight parts of water; add one part of shell or seed lac, and heat the whole to ebullition. When the lac is dissolved, cool the solution, and impregnate it with chlorine, till the lac is all precipitated. The precipitate is white, but its colour deepens by washing and consolidation; dissolved in alcohol, lac, bleached by the process above mentioned, yields a varnish which is as free from colour as any copal varnish.

The following remarks are added by Dr. Jones, the intelligent editor of the American Mechanics' Magazine:—Chlorine or oxymuriatic acid may be formed by mixing intimately eight parts of common salt and three

of the black oxyde of manganese in powder. This mixture is to be put into a retort; four parts of sulphuric acid, diluted with an equal weight of water, and afterwards allowed to cool, is to be poured upon the salt and manganese, when the gas will immediately be liberated, and the operation must be quenched by a moderate heat. If a mixture be made without the sulphuric acid, and this be added in small portions, the heat generated by this means will be sufficient to disengage the gas, without the aid of a lamp. A tube leading from the mouth of the retort must be passed into the resinous solution; when the gas will be absorbed, and the lac precipitated.

[We presume "Junius" will find in the above, the information which he some time ago applied for.—EDIT.]

FOOTING STOCKINGS.

Sir,—If W. D. Pede (p. 221, No. 217) will make inquiries in Cheltenham, he will, no doubt, hear of persons both able and willing to renovate the feet of his stockings; the writer having seen stockings so repaired for boot wear: believes they were the work of the operative weavers of Tewkesbury—a place once as famed for its *hose* as for its *victory*. It is likewise certain, that in the knitting counties of England, every old woman can, as well as the Welsh, both foot and re-foot it "as they go."

A CONSTANT READER.

Sir,—If Mr. Pede wants his stockings footed, the best and cheapest way he can accomplish it, is to buy half hose without welts, and cut the feet of his stockings off the length of the half hose, and then get some handy needle-woman to sew them to the legs of his hose. Footing second-hand stockings on the machines would cost more trouble than making new ones.

I am,
Yours, &c.
A FRAME-WORK KNITTER.

NEW PATENTS.

JOSEPH HALL, and THOMAS HALL his son, both of Leeds, in the county of York, braziers and brass founders, for their having found out or discovered an improvement in the making and manufacturing of metallic cocks for drawing off liquids. Dated October 11, 1827. *(Six months.)*

ELIAS CARTER, of the city of Exeter, in the county of Devon, upholsterer, for his having invented a new covering for the roofs of houses and other buildings. Dated October 11, 1827. *(Six months.)*

JOSHUA HORTON, of West Bromwich, in the county of Stafford, boiler maker, for his invention of a new and improved method of forming and making of hollow cylinders, guns, ordnance retorts, and various other hollow and useful articles, in wrought iron, in steel, or composed of both these metals. Dated October 11, 1827. *(Six months.)*

GOLDSWORTHY GURNEY, of Argyll-street, Hanover-square, in the county of Middlesex, surgeon, for his invention of certain improvements in locomotive engines and other applications connected therewith. Dated October 11, 1827. *(Six months.)*

JAMES STOKES, of Cornhill, in the city of London, merchant, for his invention of certain improvements in making, boiling, burning, clarifying, or preparing raw or Muscovado bastard sugar and molasses. Dated October 11, 1827. *(Six months.)*

JOHN WRIGHT, of Princes-street, Leicester-square, in the county of Middlesex, engineer, for his invention of certain improvements in window-sashes. Dated October 11, 1827. *(Six months.)*

NOTICES TO CORRESPONDENTS.

Mr. Saul will oblige us by sending the Report he alludes to.

Communications received from Mr. Ottley—Paganicus—A Constant Reader—An Old Moon-raker—The Inventor of a Portable Crank—L.—Mr. De Jongh—A. Z.—A Novice—G. W. Wilson—J. H.—Paul Pry, Jun.—Mr. Dubois—A. P.

ERRATUM.—P. 254, col. 2, line 6 from the bottom, for "under the *mind*," read "under the *mud*."

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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Mechanics' Magazine,

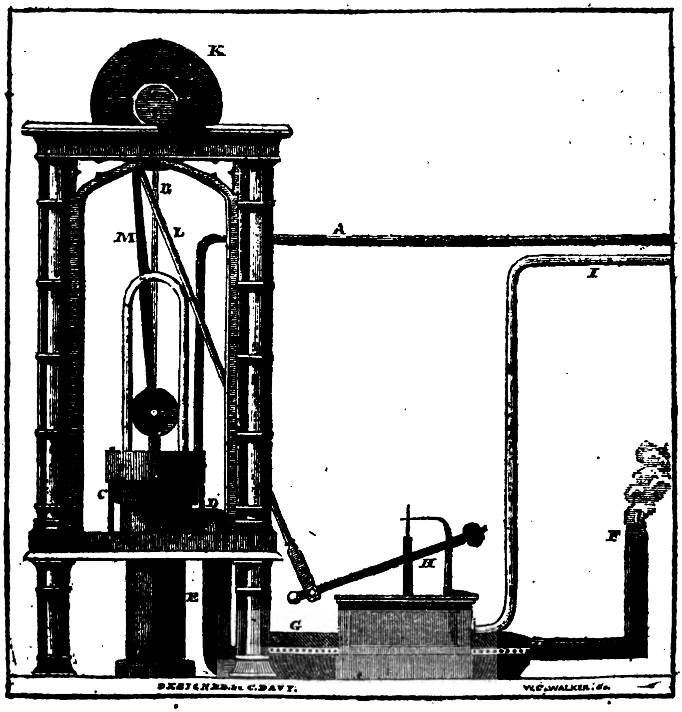
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 221.] SATURDAY, NOVEMBER 17, 1827. [Price 3*d*.

" Nature, a mother kind alike to all,
Still grants her bliss at Labour's earnest call;
With food as well the peasant is supplied,
On Idra's cliffs as Arno's shelvy side;
And though the rocky-crested summits frown,
These rocks by custom turn to beds of down.
From Art more various are the blessings sent,—
Wealth, honour, commerce, Liberty, content."

GOLDSMITH.

PERKINS' STEAM VESSEL ENGINE.



PERKINS' STEAM-VESSEL ENGINE.

[*From a Design by Mr. C. Davy, Teacher of Perspective, London Mechanics' Institution.*]

The following description of Mr. Perkins' High Pressure and Safety Engine, made applicable to the purposes of *steam navigation*, as well as the drawing prefixed, have been furnished to us by our ingenious correspondent, Mr. Davy.

A, represents the steam-pipe from the generators conveying the steam to the admission valve, lying horizontally at the back of the cylinder, and from whence it acts on the underside of the piston at a pressure of 2000 lbs. on the inch. B is a rod fixed upon an eccentric, which, by its revolution, presses the rod downwards, and by its action upon a lever opens the valve, and allows the steam to pass through into the cylinder. When the piston rises to C (the enlarged part of the cylinder), the steam is allowed to escape into the expansion vessel, or condenser, in order to effect the condensation as much as possible. The pipe D is furnished with a box, and two flap valves at E, opening upwards. At each successive stroke of the engine, the uncondensed vapour flashes off at F, and the condensation is accomplished by throwing in a jet of cold water; and this, together with the condensed steam, flows into the vessel G, which is relieved by the action of a force-pump H worked by the engine; which pump also supplies the generator with water, by the pipe I. K, the crank of the engine; L, connecting rod of the force-pump fixed to the crank; M, connecting rod to the piston. The throttle valve is placed at the lower end of the steam-pipe A; and from the throttle valve, a pipe communicates with the admission or steam valve before mentioned; the steam is cut off at a 16th part of the stroke, and there allowed to expand.

The cylinder is about 15 horse power; the piston six inches in diameter; and the length of stroke 20 inches.

We have before (see Number 200, page [36) expressed our opinion that Mr. Perkins is claiming credit for more than he has actually realized; and think it now only fair to him to subjoin what he says on this point in a letter which he recently addressed to our esteemed contemporary, Dr. Jones, Editor of the American Mechanics' Magazine. Whatever misapprehension (if any) exists on the subject with ourselves or others, may be fairly ascribed to Mr. Perkins' own want of simplicity, precision, and candour. The *authorized* statements which have been published from time to time respecting his discoveries, have been, in a culpable degree, various, loose, and contradictory. Of *vapour*, too, there has been always more than enough. Mr. Perkins would, probably, do a service to himself, by giving frank and plain answers to the following questions:

1. Is the engine which he now offers to the public the same in its master principle with that which he brought forward in 1824? About minor details there need be no dispute.

2. What is the actual saving obtained by his present engine, as proved by trial and experiment, and as compared with other engines invented and patented since 1824?

Extracts from Mr. Perkins' Letter to Dr. Jones, dated London, March 8, 1827.

"Many of my friends, and some of them very scientific men, have expressed great fears that I had attempted impossibilities; and were of opinion that steam-engines were so well understood, as to leave little that is new on this subject to be discovered. I will ask you, and I will allow no one to be a better judge, if it is not new, to generate steam of all elasticities, from the minimum to the maximum, without the least danger? If it is not new, in the generation of steam, to substitute *pressure* for *surface*, which I consider the basis of my invention? If it is not new, to have a pressure of 1000 lbs. to the square inch, on one side of the piston, while on the other side of it all resistance is taken

away by a vacuum, and this produced without an air-pump, or any more water than is used in generating the steam? If it is not new, to have invented a metallic piston, which requires no lubrication, and yet is as tight as the piston of an air-pump? If it is not new, to have applied Sir Humphrey Davy's zinc protectors to steam cylinders, to prevent oxidation? This, I found, took place in my cylinders, when the engine was not at work, after I found that I could dispense with oil. If it is not new, to dispense with the *eduction valve*, and *eduction pipe*, having no other than a small induction valve, and that so constructed, as to neutralize the pressure, requiring no oil, and very little power to open and to close it? If it is not new, to allow steam to escape at an opening 250 times larger than the steam-pipe? All this has been effected, as our friend Lukens can avouch, he having witnessed all these facts, as well as myself. And lastly, if it is not new, to have discovered that steam may be generated, although in contact with the water, at all temperatures, without producing corresponding elasticity?

"You may, my dear sir, depend upon what I have written; it is the result of actual experiment, and there is no fallacy in it. Having succeeded in making a piston which requires no oil, I am determined to ascertain the limits to which pressure can be carried. I am now making a small engine, strong enough to bear 2000 lbs. per inch; and when done, you shall know the result. Nothing but the piston will limit the power.

"The victory which I have obtained, has been a glorious one for me. For the last three months, many of the engineers have declared me insane, as I had asserted that I could condense, and produce a vacuum under the piston, without either an air-pump or condensing water; but the tables are now turned, and my triumph over those who have illiberally assailed me, is complete. By the next packet you may expect drawings, &c. of my engine; and I hope within one short year to take a seat, with my friend Dr. Jones, by the side of a generator sustaining a pressure of 3000 lbs. to the square inch; for this pressure on the generator is required to produce a working power of 2000 lbs. to the square inch upon the piston."

EMPLOYMENT OF SEALS TO DRAW BOATS.

Sir,—Your valuable publication, I find, is always open to every thing that is useful and amusing. I am induced, therefore, to send you the annexed novel and interesting idea of propelling boats, which, if put into practice, would, I rather think, astonish the curious.

Some years ago, I witnessed a sight, whilst on board H.M. ship Nereus, worthy mentioning—namely, one of our boats struck a porpoise, of no uncommon size, with a harpoon, which instantly rushed off; the line was made fast to the stem, and, to the wonder of all the spectators, she was seen to be propelled through the water at a most astonishing rate, and that for a great distance. What I propose is, that one or two good sized seals should be confined in an iron cage projecting from the

bow of a boat, with a line attached to each, and drawn tight when the boat was to be propelled. The efforts of the fish, wishing to escape, would cause the boat to move rapidly straight forward; the helm giving it, as usual, any desired direction. When the boat requires to be stopped, the only thing to be done would be to slack the lines, and allow the seals to swim at large in the cage. When she is to resume her course, let the lines be again drawn tight. A person attending to the lines in the fore part of the boat would require some sharp instrument to keep the animals on the move when lazy or obstinate.

I am, Sir,
Your obedient Servant,
GEORGE LINDESAY,
Lieut. R. N.

Gilesgate, Durham,
Oct. 21, 1827.

P. S. The strength of seals is well known to those who fish for them in Davis's Straights; and they can be procured in many parts of Scotland, particularly near Fort George.

ON MR. RUSSELL'S DEFINITION OF AN IRISH DEMONSTRATION.

Sir,—I observe that Mr. Russell, who I began to think had deserted the field, again renews the charge, although I find he does not bring any *argument* into the field; he only comes there to show he is alive and kicking (having a little recovered from his wound), and to make an apology for not having shown himself before. If any of your readers will take the trouble of reading his letter, they will find that he has not, with all his manœuvring, *attempted* to prove my Demonstrations to be *wrong*, but *flies off at a tangent*, by informing us that he is a Scotchman; and, as a finale, tells us a very good story about a *shrewd witty* Irish fellow, whom he employed to dig his garden, in the shire of "Renfrew, not a hundred miles from the sea-port town of Greenock."

Mr. Russell tries to get out of the scrape, with respect to his (would-be) definition of an "Irish Demonstration;" but, in the attempt, he makes the matter worse: he says, (p. 243, 244,) "If what Mr. H. O. has advanced *be* a demonstration, it must be an Irish one, for, in plain English, it is no demonstration at all *(at all;")* or, "if it *be* a demonstration," "it is no demonstration at all"! "But this," as Euclid says, "is absurd." Hence a demonstration is an *impossibility*. An "*Irish* demonstration," I think.

But I need say nothing more in support of my argument; all your readers who are competent to judge on the subject, will be satisfied of my correctness; and those who are not competent, may follow Messrs. Russell and G. S.'s example, and *write* their opinions.

Mr. Russell says, "we frequently meet with *half-taught* men, who, be they English, *Scotch*, or Irish, *chatter* MORE on any subject than those who are better informed." I do not know to whom he alludes; but for fear his *just* remark should become applicable to *me* (by my spinning out my letter with small-talk, like others), I shall conclude at once.

I am, Sir,
Yours, &c.
HENRY OTTLEY.

Nov. 3, 1827.

[We shall be glad to see this protracted discussion brought to a conclusion. It has ceased to be of any interest except to the belligerents themselves; and, but for their individual claims to respect, we should probably have put an end to it before now.—*Ed.*]

GEOMETRICAL THEOREM.

(Translation of a French communication from our esteemed Correspondent F.)

Sir,—The celebrated Carnot, in his *Correlation des Figures de la Geometrie*, demonstrates, by means of trigonometrical formula, a very interesting theorem. This method

being complicated, I have sought for a more simple one, by employing the principle of motion.

Theorem.

In a circle, when two chords are perpendicular, the sum of the squares of the four segments is equal to the square of the diameter of the circle.

Demonstration :

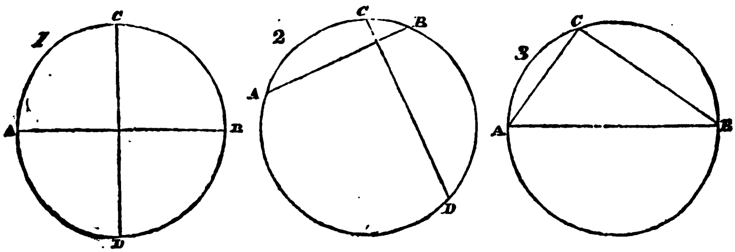
I reason thus:—

If this proportion be true in general, it must also be true when the perpendicular chords are at their *maximum* and at their *minimum.*

In the *maximum* case, the two chords are two diameters, and it is evident that the sum of the squares of four radii is equal to the square of the diameter.

In the *minimum* case, the two chords cut each other at a point of the circumference, and the sum of the squares of two lines is equal to the square of the diameter; which is, in fact, the famous proposition of the square of the hypothenuse.*

To render this demonstration plain to the readers of your valuable journal, I will suppose three equal circles.



In the first, the chords are at their maximum, and are represented by the diameters AB, CD.

In the second, the chords are moved parallel to themselves, [and are in the position represented.

In the third circle, the chords are at their minimum, and are represented by the two perpendiculars, AC, BC, which spring from the diameter AB.

I am, Sir,
Yours, &c.
F.

Oct. 20, 1827.

ASTRONOMICAL OBSERVATIONS AT ST. HELENA.

Sir,—I have read, within these few days, in the public papers, that it is shortly intended to make some astronomical observations at St. Helena, so celebrated as the last residence of Napoleon. Permit me to mention, in your useful Journal, that that island is already remarkable for having been the scene of some very important observations by the great astronomer Halley. The following historical note on this subject cannot fail to be interesting to your readers:—

To complete the imperfect catalogue of fixed stars of Ptolemy and Tycho Brahe, and to second the efforts of Flamstead and Hevelius, Halley proposed, in 1676, to go to St. Helena, situated in the 16th degree of south latitude.† Charles the Second, who had recently ceded that island to the East India Company, very liberally granted whatever was necessary for the success of the enterprise; and Halley set out in the month of November 1676. He arrived at St. Helena in three months, completed the catalogue to

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* Called the Pythagorean theorem from its reputed inventor Pythagoras, who is said to have sacrificed a whole hecatomb to the Muses, in gratitude for the discovery.—*Ed. Mech. Mag.*

† Flamstead, making his observations at Greenwich, and Hevelius at Dantzic, neither of them could observe those stars which lay near the south pole, as they do not come above the horizon in these northern latitudes.—*Ed. Mech. Mag.*

his perfect satisfaction, and returned to London towards the end of 1678.*

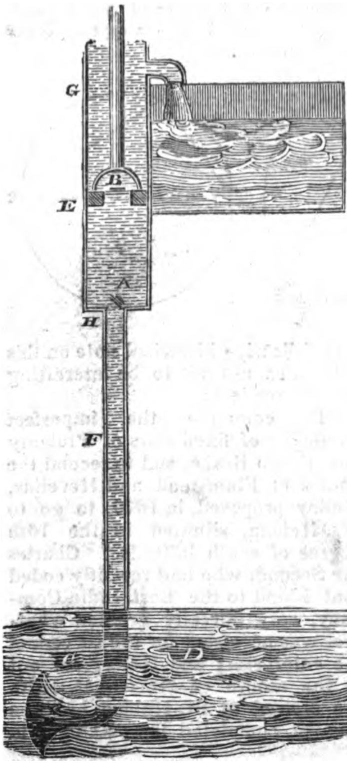
I am, &c.

F.

Nov. 8, 1827.

[We have also taken the liberty, in this case, of giving only a translation of our correspondent's French original.—EDIT.]

PUMP QUESTION.



Sir,—There is a letter under the above head in Number 219, page 252, from Mr. W. Baddeley, jun., which, as it refers to my letter (No. 217) in answer to Mr. Foord, I shall beg to notice.

I. With respect to what I said about the current, "that the current being under the mouth of the pipe, &c. must tend to increase the labour," he says, "he can put it without a doubt, by some difficulties he has experienced in working a pump in a cistern of *still* water"! How this can be, I am at a loss to understand; I cannot see the least analogy between these two cases.

II. I shall not take any notice of the rest of your correspondent's second paragraph, as that does not refer to my letter; but shall proceed at once to the third, where Mr. Baddeley boldly asserts that "neither my alteration, nor lengthening the feed pipe, will produce any good effect." Now, I would ask Mr. B. what *authority* he has for making this assertion, and what experiments he had made before so doing?

I think, however, I can convince him of his error. 1st, If the current of the water be under the mouth of the feed-pipe, will it not have to be stopped before any water can be drawn into the feed-pipe, and will not this cause additional labour? 2d. If the proposed pit be carried so deep, that the water near its bottom be *still* or nearly so, and if the feed-pipe be produced to the bottom of this pit, will not the labour required to raise the water be less than in case 1? 3d. If the feed-pipe be turned up with a "*funnel,*" as Mr. B. has *shrewdly* termed it, towards the current, will not the current tend to force the water up the feed-pipe?

III. Mr. Baddeley cannot understand how, if the current of the water be any way strong, it should press upwards and "tend to prevent the closing of the valve B of the piston E on its *ascent;*"* I shall endeavour to explain it to him. 1st. We will suppose that the water C D (see drawing) is *still*, and that it has been drawn up to E in the cylinder; then the weight of the atmosphere pressing on the surface of the water C D *exactly* poises the water E F in the cylinder, while the valve B remains closed. 2d. We will suppose that the water has been drawn up to G, above the piston; then the weight of the exterior atmosphere supports the column E F, and the water E G is supported by the

---

* Among many observations at the Isle of St. Helena, Halley remarked, in particular, the transit of Mercury across the sun's disk, which happened on the 3d November, 1677. It was the fourth phenomenon of the kind, after the invention of the telescope.—F.

* Mr. B. has given this passage quite wrong; he has quoted it thus: "The upward pressure of the water would tend to prevent the closing of *the piston valve in its* DESCENT."

piston E and presses on the valve B, which consequently still remains closed. 3d. We will now suppose that the water C D runs in a current in the direction C D, and pressing with any force x on every square inch, and that the valve B contains four square inches; the water F E will press upwards against the valve B with a force $4x$; and if the superincumbent column of water, whose base is the area of the valve B and height B G, do not press with an *equal* weight on the valve B, the latter will be prevented from closing. And this will be the case, at any rate, when the piston is near the spout. Hence, in this case, the valve B must be made of such a weight as to counteract the "upward pressure of the water." Q. E. D.

I think I have now satisfactorily proved that both the alteration I propose, and lengthening the feed-pipe, *will* produce the desired effect, and that I have refuted every objection of your correspondent. I have been more explicit than I otherwise should have been, but I thought it better to put the question "beyond a doubt" at once, and thereby save your Magazine from becoming the vehicle of *more* useless discussions.

Before I conclude, I shall give a few more hints to your correspondent Mr. Foord. On re-perusing his letter, I observe he says that the feed-pipe P H is *half* the diameter of the cylinder H G; consequently the area of the former is one-fourth that of the latter. The false notion entertained in constructing pumps thus is very common: it is thought at first sight by people, that by making the feed-pipe small, they have a less body of water to support, than if it were larger. But it is no such thing: whether the feed-pipe be equal to, or smaller, or larger, than the cylinder G H, the body of water supported by the workman is always equal to the weight of a column of water whose base is the surface of the piston E, and depth the distance E F above the surface of the water in the well. Besides this, the water moves four times as fast up the feed-pipe H F as up the cylinder E H; and consequently, when the piston has moved up *one* inch, the water in H P has moved four inches, and the labour is increased by the additional friction thereby caused. Hence it is evident that the feed-pipe being small, tends to increase the labour; and the larger it is the better.

I am, Sir, yours, &c.
HENRY OTTLEY.

Nov. 6, 1827.

P.S. By mistake, the valve A, opening upwards, was omitted in my engraving in No. 217.—H. O.

ANATOMICAL PREPARATIONS.

Sir,—In answer to your correspondent T. M. B. I beg to recommend a work generally to be found in the hands of every student, viz. *Dr. Hooper's Anatomist's Vade Mecum*, where the directions for making anatomical preparations are well described and well worth his attention; but instead of using the injections there ordered, I recommend the following, as from experience I can vouch for their superiority.

Course Injection.

Take of tallow, bees-wax, common resin, of each equal parts. Colour,* 1½ oz. to a pint.

Melt them over a slow fire, and gradually mix in the colour.

Injection for corroded preparations.

Take of common resin and bees-wax, of each equal parts. Colour, 1½ oz. to a pint.

Minute injection.

Take of double size, 1 pint; best glue, 1 oz.; colour, 1½ oz.

For very delicate preparations, as the eye (for example), solution of isinglass is to be preferred.

In the late *Mr. Shaw's Manual of Anatomy*, T. M. B. will find some excellent information on this subject.

I remain, Sir,
Yours obediently,
H. W. DEWHURST,
Lecturer on Anatomy.

Oct. 27, 1827.

Theatre of Anatomy,
24, *Sidmouth-st. Gray's-Inn-lane.*

ERROR IN VYSE'S TUTOR'S GUIDE.

Sir,—In Vyse's Tutor's Guide, page 230, is given the following rule to find the area of a trapezium whose sides only are given.

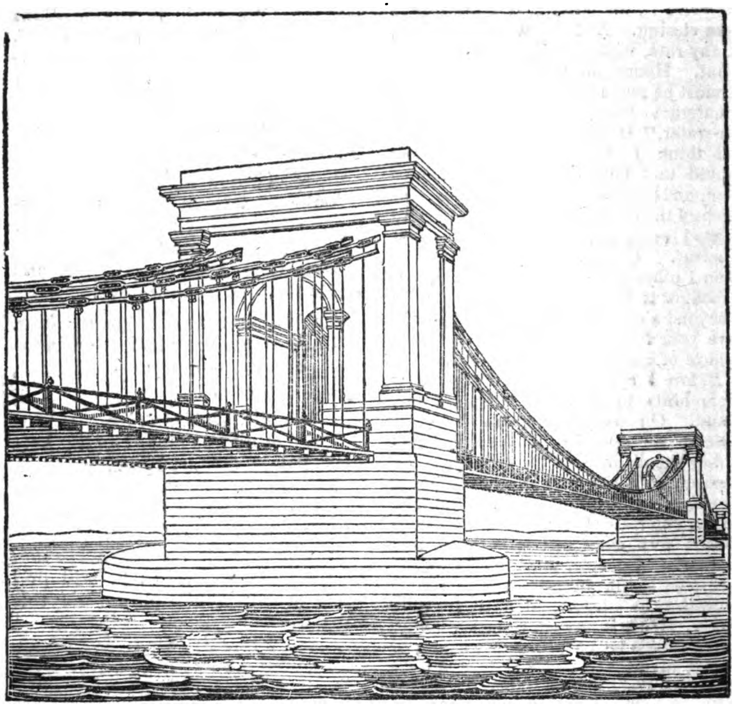
* For very common injections, *red lead* will do instead of vermilion; the latter, however, is best, as every part, if well injected, ought to be carefully dissected and preserved: this is done by every industrious student.

Rule. Subtract severally each side from half the sum of the four sides, and the square root of the product of the four remainders will be the area required.

Now two fields, whose sides will measure precisely the same, may be so plotted as to measure five acres or fifteen, yet the above rule would determine each to have the same content. The rule, therefore, I shall consider erroneous, unless some of your correspondents will oblige me by stating the reasons of its introduction.

I am, Sir,
Your obedient Servant,
GEO. W. WILSON.

HAMMERSMITH SUSPENSION BRIDGE.



Another noble iron bridge, on the same principle of suspension as that over the Menai Straits, described in Nos. 210, 211, 212, 213, of the Mechanics' Magazine, has just been completed over the Thames at Hammersmith. Prefixed is a perspective view of it. It consists of one arch, or rather, we should say, of one curve or versed sine. The distance between the outer faces of the retaining piers in a straight line is 882 feet 8 inches; the length of the chains between the same (longer on account of the curve) is 841 feet 7 inches. The links were all previously tested to 45 tons each. The contractor for the erection of the bridge was Capt. S. Brown, R. N.; and the whole of the iron work, with one or two exceptions, was manufactured at the works of Messrs. Brown, Lenox, and Co. Newbridge, near Cardiff, Glamorganshire; where the iron work for the Union Bridge over the Tweed, the Brighton Pier, and several other bridges of suspension, was manufactured. The total weight of the iron work was 472 tons 2 cwt. 1 qr. 24 lbs. The following list of the number and weight of each article has been furnished to us by the manufacturers, and is now, for the first

time, published. Practical men will feel indebted for the specific information which it conveys. Part of the articles marked * were made at the Brierley Hill and Gospel Oak Works; those marked ** were wholly manufactured at the former.

List of the Number and Weight of Articles of Iron Work furnished for the Hammersmith Suspension Bridge.

	Tons.	cwt.	qrs.	lbs.
*2646 Links, 8 feet 9¾ inches to the centre of the holes drilled to receive the joint bolts—5 inches wide, 1 inch thick: each end of these links for 10 inch. 8 inch. wide	213	16	0	14
36 Circular links, 5 feet 9 inches to centre of the holes, to rest on the rollers of the carriages in the towers; upper line of chains, 5 inches wide, 1⅛ inch thick; the 8 in. wide for 10 in. each end;				
72 links, 3 feet 10 inches wide, to join do.;				
72 do. 7 feet wide, to join do.;				
18 do. 9 feet 10 inches, centre of chains, upper line, do.;				
18 do. 4 feet 6 inches, next retaining link, Surrey side;				
18 do. 10 feet 8¼ in. next retaining link, Middlesex side;				
36 circular links, 5 feet 4 inches wide, to rest on the rollers of the carriages in the towers;				
72 links, 7 feet 4 inches, to join lower line of chains;				
36 links, 9 feet 3 inches, centre of chains, lower line;				
Carry forward	213	16	0	14

	Tons.	cwt.	qrs.	lbs.
Brought forward	213	16	0	11
18 links, 9 feet 4 inches, to join retaining links, Surrey side; 18 do. 6 feet 9 inches, to join retaining links, Middlesex side	26	1	0	22
** 72 retaining links, 4 feet 7 inches; one end of each of these links 2 inches thick, for 18 inches, with oval holes, 4½ inches by 9, to receive the retaining bars	5	16	3	26
** 16 retaining bars, 4½ inches by 9, 2 feet 6 inches, and 3 feet 6 in. long, fitted to the retaining links	2	8	2	22
3762 side plates, 1 foot 3 inches to the centre of the holes, 8 inches wide, 1 inch thick, drilled as the long links, 1 inch hole in the centre, to receive bolt for vertical links; 22 do. 2 feet 1½ inch, do. do.	83	8	2	11
688 joint bolts, 19 inches long, turned to 2¾ inches, and screwed at each end, 3 inches 3-16ths square thread, for the 6 bar chain; 688 do. 13 inches long, turned as above, for 3 bar chain	15	1	0	5
2752 cast iron nutts for do.	30	6	2	17
1288 vertical links, 12 inches long, 1 inch square iron, 1 inch hole at each end, to receive a bolt to connect the suspension rods	3	0	2	0
96 suspension rods, from 1 foot 8 inches to 31 feet ½ inch, between the towers and retaining piers, on the Middlesex				
Carry forward	380	19	3	2

	Tons.	cwt.	qrs.	lbs.
Brought forward	380	19	3	2
side; 324 do. from 2 feet 4½ inches to 31 feet 7 inches between the towers; 96 do. from 1 foot 8 inches to 31 feet ½ inch between the towers and retaining piers, on the Surrey side . .	14	5	0	12
(These rods are 1 inch square, with a socket at the upper end, to receive the bolts, to connect them to the vertical links, and the lower end 2 inches by 1½ inch, with a mortice 5 inches by ⅜, for the gibbs and keys, to support the beams of the roadway.)				
1370 bolts, screwed, from 3 inches to 13, for the vertical links and suspension rods	2	1	2	22
1280 double keys, and 630 gibbs, for the lower end of suspension rods .	1	9	3	20
657 toras beads, to fill in between the sockets of suspension rods and vertical links . .	0	4	2	24
8 cast iron double standards on plates, for towers .	26	14	0	16
36 cast iron rollers, 14½ inches long, 11 inches diameter, with wrought iron spindles 3 inches diameter, resting on brass bearings, for the standards and the 6 bar chain to pass over; 36 do. 8½ inches long, 11 inches diameter, for 3 bar chain to pass over	9	18	1	26
144 brass bearings for do. . . .	0	13	0	4
Carry forward	435	7	0	17

	Tons.	cwt.	qrs.	lbs.
Brought forward	435	7	0	17
Screwed bolts and nutts for the standards . .	0	6	1	13
8 cast iron retaining plates, (cast in London) . . .	30	0	0	0
16 saddles for do. to receive the retaining bars for the end or retaining link; 24 packing pieces for do. . .	6	9	0	22
Total	472	2	2	24

ON SMOKY CHIMNEYS.

(For the Mechanics' Magazine.)

It appears that smoke is composed of those gases which escape from combustion; heated, partly by previous contiguity to the flame, partly, perhaps, by the evolution of caloric, in the process of uniting with the gases of the atmosphere.

As heated air is lighter than cold air, the above, in its natural ascent, carries with it numerous particles of carbon, and such light bodies as can be detached from the fuel as it passes through; and these, to common observation, constitute the great visibility of smoke; when, without those opaque particles, it is usually denominated "vapour."

As smoke becomes cooled by admixture with the atmosphere, the ascending current, occasioned by the great difference of temperature, ceases; and it spreads in every direction, throwing down the carbonaceous particles, which are all heavier than the air.

To confine this heated air laterally, and to cause it to carry off their collection of sooty particles beyond the reach of annoyance, chimneys are constructed. They answer the purpose of preventing its uniting too soon with the cool atmosphere; for, so long as this can be effected, it will continue to ascend.

When the apartments in a house are small, and closely constructed, it frequently may happen that the air within them is partly consumed or changed by animal respiration;

by combustion in some other apartments; by absorption of the surrounding bodies, materials of the building, &c; and such effects may often occasion an unequal pressure of the atmosphere, and an influx of external air to pour down the chimney. This is of less frequent occurrence in old houses than in new ones; because the wood-work of the casements, doorways, &c. shrinking with age, admits an interchange of the external and internal airs. But smoky chimneys cannot always be attributed to this source.

Now, as any substance lighter than water will rise from the bottom at a rate proportioned to its bulk, (for instance, compare a particle of cork the size of a pea, and a piece six inches square,) so hot air will force its way through that which is cold, in a ratio proportioned to its bulk and density; allowing a common medium of heat.

The force of the air which proceeds from a common fire, is not to be estimated by its lateral expanse, but inversely by its height; because expansion either in one direction or another can make no difference as to the quantity, but it very considerably diminishes its density, and therefore reduces its power of ascent; for not only does it cool by admitting that air which is colder, but it is less able to overcome the resistance from above.

Thus, a log of wood whose length is ten times its thickness, will rise from the bottom of the sea with ten times the force in a vertical position, to what it will in a horizontal position.

When a column of smoke, the diameter of a common room fire, is allowed to expand "laterally," it unites with the cold air, and its ascending force is almost immediately dissipated; but if it is so confined, whatever force would appear to be lost by "vertical" extension, is instantly supplied by the fire below; so that, in fact, its rate of progression is increased, just as a number of corks run loosely upon a string fastened at the bottom of the water, and suffered to escape up that string in various proportions, will show that the ascent of two will be at a greater velocity than that of one; four than that of two; and so forth; and at twice the rates of the corresponding numbers in a horizontal position. And the effect would be precisely the same if a tube were substituted for the string, and they were suffered to rise through it. But if the corks were only half an inch in diameter, and the tube a foot, the use of a dozen loose corks would be only as that of one, because they would separate in a lateral direction.

This example will sufficiently attest the bad effect of a chimney whose diameter is greater, not only than the fire-place, which it often is, but than the actual proportion of ignited combustibles; when, in fact, it ought to be smaller.

Both the soot, and the vapour which conveys it, are compressible into an inconceivably narrow compass; so that be a chimney ever so constructed, there can be no fear whatever of want of room for the passage of the smoke; and, as the lateral compression adds at least in a twofold ratio to its ascending force, it would surely be advisable to proportion chimneys accordingly.

We have seen that the wider a chimney is, compared to the size of the fire, the greater quantity of cold air it will contain, and by so much the sooner the ascending stream is cooled; when not only is it unable to resist the perpendicular pressure of the atmosphere from above, but the additional inconvenience is, that the soot descends by its superior gravity—part coming back into the house, and the rest lodging in the chimney; so that a wide chimney is foul much sooner than a narrow one.

But again, a body of water in rapid motion, passing through an inert body of water, will cause an eddy or reflux by the friction of the particles, and the resistance given by the inertion of that which is at rest; and when there is resistance to any body in motion, there will be a reverberation. So, in a wide chimney, a small stream of heated air ascending, produces a

reflux of the inert cold air through which it passes; and this carries with it all the fuliginous particles which fall into it.

The best chimneys must be those which are of narrow width, and in a direction of considerable inclination; because by those means the perpendicular pressure of the atmosphere is reduced, the departing vapour acquires an additional impetus from non-resistance, and the warm air from the room does not so readily escape.

The velocity with which the heated air, passing through the fire, will escape under those circumstances, causes an absorption of that also which is in contact with it. Thus the action and the consequences are reciprocal; the cool air of the room drawn into the vortex, blows the fire, and supplies it with its oxygen; and the fire being increased accordingly, so is the absorption of the cold air, and the discharge of that which is heated: and yet the privation of the warm air of the room is not near so great as when a chimney is large, because then, besides what supplies the combustion, the greater draught takes place between the fire and the flue.

An aperture at the back of a fire, in a horizontal direction, and communicating with a chimney, would produce this effect more perfectly, because the whole of the draught would pass through the fire, and there deliver its oxygen.

The first effort, therefore, towards the cure of smoky chimneys, should be, to close up, as far as can be got at, all those chambers or cavities so inconsiderately left at the lower part; then to reduce the apertures—the upper one in particular—as much as possible. Secondly, to draw the grate out into the room; which will have the effect of heating the air in the apartment much more, and will give a degree of horizontal direction to the smoke, and by so much an impetus ere it arrives at perpendicular ascent.

It is often to be perceived, that in chimneys which are wide only at bottom, the smoke curls down at the sides, and occasionally enters the room; this is caused by the cooling of the external part of the volume which ought to ascend. And it often occurs that a chimney will smoke on the lighting of a fire in another room; the cause of which is, that, as fire cannot exist without atmospheric air, and the apartments being confined or close, as much air is already absorbed, as can be admitted without disturbing the equilibrium; and neither of the fires would burn, but that the vacuum is supplied through one chimney or the other.

Sometimes, a fire will smoke when the door is open, which is owing to the demand for air being great in other parts of the house; the equilibrium is lost either by exhaustion from other fires, or from other causes. A fire will sometimes smoke into the room, when both window and door are open, by the demand for air being so great in other parts, as to draw the whole of what is admitted in a strong draught, and that also which comes down the chimney.

It is seldom that a room will be smoky, when the window alone is open; but if it is, the cause will probably be found in the stillness and heaviness of the atmosphere, and the consequent slowness of commixture of the outward and inward air. But if in windy weather, it may be owing to the draught having got possession of a defective chimney: or to reverberating winds from higher bodies.

These observations apply equally to the chimneys of wind furnaces; but I never saw one too large in proportion to the fire, and their great length enables them to contain a greater quantity of warm air. For the increase of draught, they should not be perpendicularly placed over the fire, but a few feet at the lower part should be built in a direction nearly horizontal; and this might easily be done by supporting the superstructure on a pillar. To facilitate the sweeping and cleaning of it, an iron door might be set in at the angle.

PAGANICUS.

REPLY, BY LIEUT. W. P. GREEN, TO MR. HARRIS ON LIGHTNING CONDUCTORS.

Sir,—Your correspondent, Mr. Harris, having given vent to his angry feelings, aided by "Amicus" and his country friends, I have now to crave the indulgence of your inserting my reply in your miscellany, and to solicit a continuation of the insertion of experiments and phenomena in corroboration of my remarks.

It can scarcely be from defect of memory that Mr. Harris has omitted to apprize those who read his compositions, that he is the disappointed promoter of the plan (first suggested by Mr. Singer) of fixed conductors, explained in the accompanying drawing and description, and that his disappointment was chiefly caused by the queries I put to him at his public lecture, when he was surrounded by a host of friends who had conceived a mistaken view of the matter. His Majesty's ship Java had been in part fitted on this plan, preparatory to its adoption by the whole fleet; and, but for my exposure of its insufficiency, it would, no doubt, have come into general use, greatly to Mr. H.'s pecuniary advantage. Had Mr. H. stated these facts, they might probably have served to explain to your readers why I am now assailed with such virulence by himself and friends.

Mr. Harris has no personal cognizance of phenomena to bear him out in one instance, but is wholly guided by the mistaken views of others. He catches at typographical errors, uses evasive remarks, and glances over palpable blunders, in hopes to make his theory good. But it will be seen, that, with all this aid, and that of the conductors of "Amicus" and Mr. Corydon,—the one useless from not having a sharp point, and the other from not touching the sea,—the fallacy of his remarks must be obvious to the understanding of every seaman and man of accurate research, leaving science out of the question.

In No. 214 of your Magazine, Mr. H. says "my statements are unsupported by fact, and not warranted by any scientific discussion," forgetting the occurrences at his lecture, and my experiments, which have proved his plan to be dangerous. He states, that I quote a paper, "dated in the year 1824," to confirm the damage done by the effects of conductors placed in 1825; but it will be seen, by referring again to my letter (Mech. Mag. p. 14, vol. viii.) that I expressly stated the date of the paper to be "June 18, 1827." Mr. H. has been here guilty of a misrepresentation, which I know not how to characterize as otherwise than grossly wilful. The quotation respecting the damage to Charles's Church was *not*, as he alleges, made from a letter inserted in the *Plymouth Chronicle*, in order to prove the utility of conductors, but was an honest statement, by the Editor of the *Devonport Telegraph*, of effects which had come under his immediate observation. A more convincing proof of the whole of what I attempt to establish cannot be adduced, than the fusing of the conductor of this church at Plymouth. It shows the utter inadequacy of any such conducting medium to avert an electrical discharge. With respect to the Milford, "which had not a conductor," being struck, while numerous ships around it, which were fitted with conductors, escaped; have I not as good a right to infer, that the ship was struck in consequence of the many attractors near it as the reverse? Mr. H. says, this thunderstorm "did not occur at the time of firing a salute." Who asserted that it did? I only said beforehand, that the numerous conductors attached to the fleet, at Plymouth, would some time or other attract over that port a cloud so heavily charged with electric fluid, as to cause the greatest damage, and that this would, "in all probability, occur at the moment of *firing a cannon*, OR A SALUTE." When the event actually happened, cannon *were* fired for the purpose of weakening the force of the electric cloud; and why so, if the conductors had afforded sufficient protection? As it was, the result proved fatal to many ships, although Mr. H. notices the "Milford" only, because that alone seemed to suit his theory.

Mr. Harris may be authorized to use the names of officers, for I myself heard, to my astonishment, one who spoke in support of his plan at the lecture, declare "that he would sit upon a barrel of gunpowder, and permit Mr. H. to pass an electric shock through it." Now, Mr. Editor, I must confess that, although I fought not far distant from Nelson when he so gloriously fell at Trafalgar, and have seen a little service, yet I have not acquired nerve strong enough either to induce me to sit on the powder-barrel, or to remain unconcerned in my cabin, or in the ship's magazine, while experiments are making with such a conductor; particularly under a heavy charged atmosphere of many miles, such as I have witnessed in a tropical climate, where the power of the ether has been sufficient to fuse an iron mast.

Mr. Harris, in No. 215 of your Magazine, states, that accidents occurred to

powder magazines previous to the discovery of conductors, but that *no such instance is since on record*—judging, I imagine, that I am ignorant of the circumstance of Purfleet powder magazine being struck in the year 1778, though guarded, as it is termed, by pointed and the most approved conductors. The Privy Council, in this instance, and the Royal Society, in the case of the Heckenham poorhouse, gave convincing proofs of mistaken views, and being self-concerned to veil such errors. In your No. 57, (which I cannot, however, at present, put my hands upon) the circumstances I have just stated are fully authenticated; and in that Number, Mr. H. is also confuted in his assertion of my not being supported by any scientific discoveries or persons; for it is therein mentioned, that Professor Leslie states lightning rods to be useless. The Professor's paper appeared two years after my advancing such an opinion, with the additional statement—"that lightning conductors are attractors and accumulators, and not protectors, and are merely sufficient to control the superabundant electric fluid which may come in contact with them."* The conductor of St. Paul's, London, the largest ever put up, was, by a moderate stroke of lightning, heated red hot, and therefore judiciously removed as dangerous and useless. Mr. H. states, in No. 216, that I propose a lightning conductor, but omits my words "to those who *will* have conductors." I should be far from ever claiming any merit for inventing lightning conductors: I have always rejected them, and accounted for ships being secured from the stroke of lightning, by their hundreds of wet ropes being, in the absence of conductors, exhausters, and not attractors or accumulators of the ether. By them the ether is not drawn to a focus, as with a conductor, which is too often not sufficient to control it; when the consequence is a dreadful explosion.

I affirm that Mr. Harris copied from Mr. Singer (and the idea is his of bolts through the keelson), who proposed to place bolts at the keel of the iron masts, for the transmission of the electric fluid through the keel into the sea, and to place flexible conductors from the head of the lower masts to the truck, (see the 47th volume of the Philosophical Mag. page 136). This being suggested, what is due to Mr. Harris, for an invention which compels us to destroy the substance of our ships' masts, and to blow up those ships?

Professor Richman proved his mistaken view of the accumulating power of lightning. All I name this occurrence for is, to prove that rods *are* attractors. Surely, if the Professor had not placed one to his house, the accident by which he lost his life could not have occurred, and the fluid would not have been conveyed to the street, to injure the people who Mr. H. asserts were injured.

Franklin's mistaken views of the sized rods proper to protect ships and buildings, was decisively shown by that of St. Paul's being made red hot; and afterwards by one being fused on board the American ship "New York," it being made after his directions.

Are we to be told, without insult to our understanding, that Heckenham poorhouse was not properly protected? Does Mr. H. intend to affirm, that eight conductors affixed to one house would not be a protection, unless eight wells were dug to carry away the fluid? Can he answer for the water always touching the rod? (which is stated to be an indispensable requisite). Does he mean to say, although the lightning is attracted to the point of the conductor, unless it terminates in water, that the superabundant fluid will, as if by instinct, reascend and fire the house? If lightning is once conveyed to a rod, it will readily find its way to the earth, which, whether wet or dry, by means of its open pores, will disperse it. Such assertions as his, if correct, prove all conductors not terminating in a well, and not having the end of the rod or chain immersed in water, to be useless and dangerous.

Mr. Corydon states, that a ship conductor is useless, unless it is actually touching the sea; not being aware that this is not possible at all times, because a ship under a press of sail lays over, and the conductor is at such times, and ever has been since their adoption, from one to two, and often five feet, above the surface of the sea; notwithstanding which, the fluid is perceptible when darting into the sea.

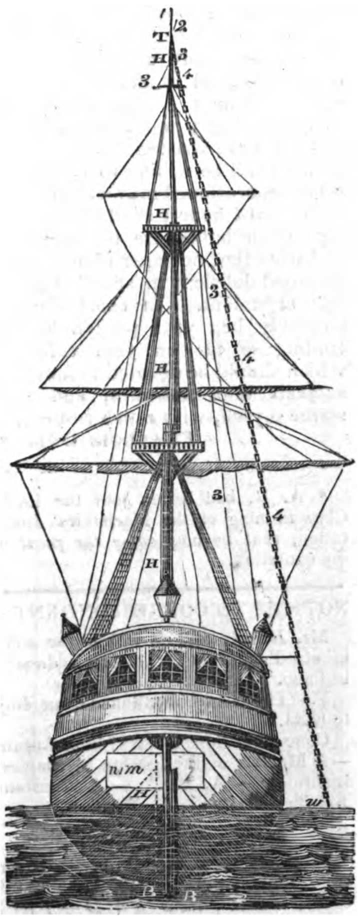
Mr. H. asserts, that I refer to no authority for the effect of the lightning upon His Majesty's ships Kent and

* The article alluded to by our Correspondent, will be found at p. 9, vol. iii. The conclusion of Mr. Leslie, as there given, is, that though "the cloud exerts an attraction on the surface of the ground, the force depends solely on the distance, and is not in the least degree affected by the shape or quality of the substances below; rolling towards the nearest and most elevated objects, and striking indiscriminately a rock, a tree, or a spire."—EDIT.

Perseverance, although each was armed with two pointed conductors; forgetting that I named the captains of both ships, and the place where the circumstance occurred, and that there were more than one hundred officers, and a thousand seamen, and many marines, to witness the circumstance.

(To be continued.)

Description of Mr. Harris's Conductors.



1 is the spindle of Mr. Harris's proposed conductor, screwed into the solid mast, passing down eight or ten inches, and extending one foot above the truck T.

The dotted line H H H shows the continuation of the conductor from the spindle, passing under the rigging to B B, bolts driven through the keelson to conduct the electric fluid into the sea after passing through the powder magazine M M, shown in the after section of the ship, containing some thousands of common cartridges, in barrels hooped with copper. The conductor is strips of skin copper-nailed to the mast, grooves being cut out to receive these strips.

2, the spindle of the chain conductor—such as used at sea, hoisted up by the haulyards *s s s s*.

4 4 4, the continuation of the chain to or near the water *w*, extended from the rigging and hull of the vessel by the staff *o*.

3 3 3, iron cross-trees, or jacks.

REPLY TO A. B.

"Tantæne animis cœlestibus iræ?"
VIRGIL.

"An I had known he was so cunning of fence, I had seen him d—d ere *I had fought him.*"
SHAKSPEARE.

Sir,—I must confess I feel sorry you should have admitted such a letter as A. B.'s last into your very valuable Magazine.* I feel so, not because I think that he has at all answered me, but because it does not contain one single word which deserves the name of a defence. He accuses me of unfairness in "misquoting, misstating, and misapplying." Yet of all these he brings no example! The charge, Mr. Editor, I deny *in toto;* and I challenge him to produce any instance in which I have been guilty of misquotation, misstatement, or misapplication. He tells me that the only quotation in which I have been successful, is a misprint. So far from thinking it the only one in which I have been successful, I thought when I quoted it, and think so still, that it was the least so, and merely quoted it to add a little to the other parts of his paper I had shown up. The quotation is, hint the ninth, and when amended, stands thus:—"The

* Our Correspondent forgets that A. B. was the attacked party, and that it is not anywhere usual to refuse a defendant permission to vindicate himself in his own way.—EDIT.

strength also of the steam would be better *ap*plied." — Certainly this would be very far from being the case, if his meaning be, that the strength of the engine would be better applied (but in truth the sentence is so ambiguous, I scarcely know what he intends by it). He seems not to know, that it is more difficult for a ship to make its way through a stream running more than five knots an hour, than through still water; and, therefore, very sagaciously tells us, that by placing the engine so as to increase the length of the stream through which the ship passes, we are employing it to greater advantage! He asks me, with great triumph, whether I have ever seen a porpoise or whale? To which I answer, that I have seen both. Now, let me ask him, have you, my good Sir, ever seen either? If you have, you must have supposed that I had not, or how could you possibly speak of a porpoise as a model for a steam vessel,—a fish which has a tail, the plane of which is at right angles to the plane of his side; or, whose tail is turned the opposite way from that of most other fishes, as it lies flat on the water, like a flounder. The consequence is, that he advances but very slowly on his course, turning over topsy-turvy every half minute or so. A pretty thing it would be to have a steamer revolving in the water, pitching bowsprit under and setting up her stern in the air, and at last completing the somerset. Possibly there might be a danger of its remaining keel upwards when it had completed only half its somerset, which I suspect, would be rather a tickler for the passengers and crew. As to the whale, it is true he occasionally *comes to the surface* to breathe, and at other times swims so near the surface as to show his back fin above water; but I suspect, were A. B. to try a voyage on a whale's back, he would find it *rather too wet*, and prefer, for his next trip, the deck of a steamer. A. B. charges me with being choleric and *feeling sore:* for what, I should wish to know, should *I* feel sore, who never wrote a word before to which A. B.'s paper could apply. As to his blaming me for quoting Juvenal, let me tell him, there are many of *us Mechanics* who understand Juvenal.* But even were I not a mechanic, is that any reason why I should not expose error when I meet with it? And am I neither to presume to read the Mechanics' Magazine nor to write for it? Let me tell him, the Mechanics' Magazine is such a work as is below no man's reading; and many abler men than either A. B. or Francois Dubois, both read it and write for it. Fair argument I shall always be happy to meet; and if any one can show I have written too harshly of him, I shall be willing to make him every reparation. I may write caustically, but I hope I shall never apply my caustic but where it is needful; and trust that no paper of mine will be found deficient in sound sense or fair argument. In conclusion, I sincerely beg your pardon for intruding so far on your columns, which should be devoted to far other subjects than *polemics*, and subscribe myself, with much respect,

FRANCOIS DUBOIS.

* A. B. had better join the Latin Class forming at the Mechanics' Institution, that he may *enjoy the point* of my quotation.

NOTICES TO CORRESPONDENTS.

Mr. Dubois and J will please send to our Publishers for letters addressed to them.

F.—The letters mentioned came duly to hand.

Communications received from Aurum —A Member of the London Mechanics' Institution — A. B. C. — A Constant Reader—Mr. Saul—E. W. S.

ERRATUM.—In Mr. Benwell's paper on Annuities, in No. 219, in the third or last formula, for $x\,(p + D -)$ read $x\,(p + 1) - 1$.

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Mechanics' Magazine,

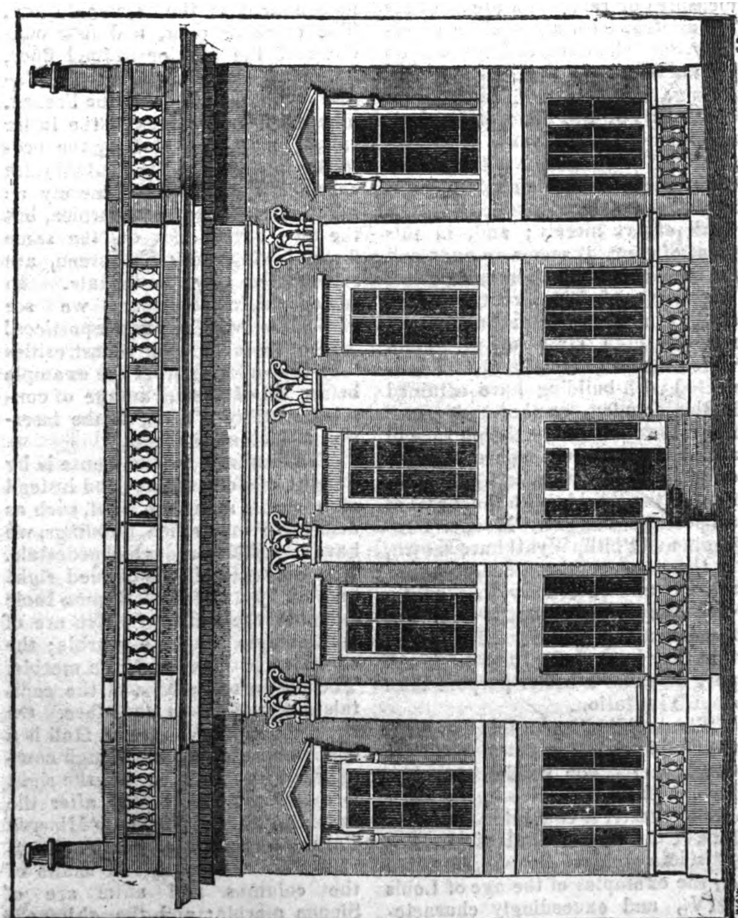
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 222.] SATURDAY, NOVEMBER 24, 1827. [Price 3*d*.

"The passions and desires, like two twists of a rope, mutually mix one with the other, and twine inextricably round the heart; producing good, if moderately indulged, but certain destruction, if suffered to become inordinate."

BURTON.

CROCKFORD'S CLUB-HOUSE.



CROCKFORD'S CLUB-HOUSE.

(From the Communications, chiefly, of Mr. Davy.)

The name of the building which is about to be described must be familiar to every one, from the volumes of reprobation which the press has poured forth on the purposes to which, according to common report, it is intended to be devoted. With the moral considerations involved in the case *we* have nothing to do; though, perhaps, were we to enter into them, we might be tempted to show, that however much the vice of gaming is to be condemned, all arbitrary measures of repression are not only inconsistent with a free state of society, but calculated to force back on private life that current of depraved feeling, which, through public establishments of this description, finds an easier and safer vent. Our present business is to take notice of this Club-house, or Pandemonium, as it is called by its denouncers—as a work of art merely; and, in this point of view, it seems to us to call for unmixed admiration and praise. We know of few structures that exhibit in a more remarkable manner the high state of perfection which the various manual arts connected with building have attained in this country, or that may serve more to redeem our existing race of architects from the opprobrium of only furnishing the best of workmen in the world, with the worst of all possible designs. Messrs. Benjamin and Phillip Wyatt have shown, in the plan of this edifice, both internally and externally, not only a very correct taste, but a degree of freedom and originality which shows that they have studied the models of past times for a better purpose than slavish imitation.

The building has nothing at all of the Gothic style, nor yet much of the Grecian: the one would, probably, have been of too solemn, the other of too chaste, a character for a palace of the mother of all vices. But it is in a style of its own, founded on the examples of the age of Louis XIV., and exceedingly characteristic of the circumstances which have led to its erection, and the purposes to which it is to be appropriated;—combining with great judgment some of the *richest* features of *many orders*, and exhibiting all that profuseness of costly decoration in which *fools of quality* delight.

The external appearance of the building does not lay claim to any particular architectural beauty; yet there is much judgment displayed in some of its combinations. Four Corinthian pilasters, with a corresponding entablature, surmounted by a balustrade and pedestals, form the façade. The body of the building consists of two principal stories, independent of the basement story. The entrance door, and four windows of the first or ground floor, are in the Venetian style; the windows of the upper floor in the French. The three centre ones of the latter range, being protected by the projecting plaisters and the entablature over-head, have each merely an architrave, frieze, and cornice, but the two outer ones on the same floor, having no such screen, are surmounted by pediments. In some public structures we see *pedimented* windows under porticos! The authors of such monstrosities may take a lesson from the example before us, of the advantage of consulting utility a little, in the insertion of such appendages.

The entrance to the house is by a flight of stone steps; and instead of iron rails along the front, such as deform so many fine buildings, we have stone balustrades and pedestals. The Entrance Hall is divided right and left by a screen of Roman Ionic columns, the shafts of which are of verd antique scagliola marble; the capitals and bases of white marble. The abacus and scrolls of the capitals are hollow on each face. On the right of the Entrance Hall is a coffee-room, of a plain though commodious description. On the right is a library, constructed after the manner of the Temple of Minerva Polias, but with a greater luxuriance of ornament. The shafts of the columns and antæ are of Sienna marble; and the chimney-

pieces of black marble inlaid with gold.

The staircase which leads to the upper rooms, next attracts our attention. It is of an oblong construction, the stairs occupying three of its sides, and terminates in a gallery supported by Ionic verd antique columns, similar to those before mentioned. From this gallery the ceiling above is supported by columns of the same material and colour, but of the Corinthian order. These columns stand on pedestals, and the intercolumniations are filled by balustrades. The curved surfaces or shafts, which are wholly of veined marble, are elegantly carved, exhibiting an extremely rich foliage. The walls of the staircase, as high as the cornice, are cased with scagliola marble, in imitation of *Sienna;* the balusters of the stairs are metal, with a French foliage richly chased. The staircase ceiling rises from a cornice, the principal member being a large cove or cavetto, above which is an enriched phaneer and cornice. The angles in the flat of the ceiling are ornamented with spandrill pannels, enriched with trophies. The central part is pierced with an elliptical dome; the diameter, *in proportion,* is three-fifths the width of the entire ceiling. The concave part of the dome is also very richly ornamented. The lights in the dome are formed into two divisions; the upper division is of stained glass, and the lower has a rich patera alternating with the glass. The lower part of the ceiling is supported by trusses, each surmounted by a female head.

We now proceed to the saloon, which occupies in length the three central windows in front; a space of between 40 and 50 feet. The ceiling is divided into compartments, each having its trophy or ornamental centre, and bounded by a large enriched cove with a cornice top and bottom (also enriched). The walls are literally covered with plate glass; and the styles which divide the pannels are most superbly carved. Some of the plates measure 6 feet by 10 feet. The end of this magnificent saloon, on the right, opens to an ante-room, of an octangular plan, with niches in its additional sides; the four square sides being occupied with a window place, saloon door, and a door communicating with the supper room.

Great as is the splendour which we have (almost vainly) attempted to describe, as belonging to the other parts of this edifice, it is surpassed by the supper room. It seems, at the first glance, to realize our ideas of the enchanted palaces of the Genii. The walls, like those of the saloon, are covered all over with plate glasss. The ceiling it would be a difficult task to give any thing like an adequate idea of. At each angle is a very rich shield; and a border of several ornamented members is continued round the ceiling, and forms, for the central part, an oblong, with its angles hollowed out by a quarter of a circle. The centre of the ceiling is decorated with an oval patera, displaying a most beautiful arrangement of the grape vine ornament. The remaining space of the ceiling is filled by lozenge pannels, with a patera occupying the centre of each. The whole of this richly variegated roof is superbly gilt. The principal part of the ornaments are manufactured in a *paste composition,* and exhibit workmanship of a very superior character, reflecting the highest credit on the taste and ability of the manufacturer, Mr. Jackson, of Rathbone Place. Nothing, we believe, on so large a scale, has ever before been attempted in this kind of composition.

ALE BREWING.

Sir,—When I commenced reading your entertaining and useful Miscellany, I never supposed that I should ever contribute to fill its pages; but having been drawn in to do so, I will readily contribute my mite so long as it may prove beneficial or entertaining; and, as my former letter met with such a favourable reception, I will with pleasure give every information in my power on the subject of brewing, from the persuasion that man was

made for man, and that we should be helps meet for each other.

I shall, therefore, commence by answering any queries I am capable of, which have been made, by your correspondents in the last month's Number, and then give you the remainder of my method.

I perfectly agree with your correspondent, A. Z., (p. 151, vol. viii.,) that "few people adopt the same rules, nor can one practitioner in a thousand give a satisfactory reason for his process." *I am sure I cannot;* yet I can make good beer, although I am no chemist, and understand but very little, if any, *of the nature of gluten and its insolubility;* yet while I can accomplish my end at as little (perhaps less) expense than some of my neighbours, I do not therefore intend to commence student.

It appears "A. Z." allowed three bushels of malt to produce only twenty-four gallons of ale. Either he is fond of very strong ale, or he did not derive the quantity from it which I am of opinion he might, and yet have procured good ale. As to his fears about the expense of fuel for boiling wort three hours, I think them groundless. I can assure him, from actual experiment (for I invariably superintend my brewings, and never leave them to my servant), that, provided his furnace has a door to its ash-pit (which may be a piece of slate or iron), and its chimney fitted with an iron slide, after the manner of the patent ovens, he may *keep* his liquor boiling a great length of time, by proper management of these appendages, with *very little fuel.* I beg leave to assure him I have continued the boiling of my wort for a whole hour without once opening the copper door to introduce fuel, nor am I aware that he needs so large a copper as he supposes necessary; he might boil his worts (as I do) in two equal divisions, adding some spare wort as the evaporation proceeds.

I beg your St. Alban's correspondent (*) (page 190), will accept my thanks for his favourable opinion; and with much pleasure will I give him an answer. The hops I use are reserved out of the bulk after being strained off. I do not take them from the strainer till next morning, and, in order *to keep them till wanted* (which I presume answers your correspondent's inquiry), I put more than I shall require into a small box; or tub, and press them down close, cover them over with a piece of wood, and lay a weight upon it to exclude the air, which otherwise would occasion them to mould; *or* put only the quantity I think I shall have occasion for, into a jar, &c. and draw some stale beer upon them, which I prefer: when my beer has ceased working, I put both hops and stale beer into the casks. It is quite immaterial whether they are put in *wet* or *dry.*

I trust your friend will not be offended at my declaiming against isinglass. I have always an idea that it produces flatness in the beer, particularly when dissolved in water. Stale beer is far preferable; in which, with a little assistance by heat, it will melt freely. I have not used an ounce for my beer in the last seven years. Many of my neighbours use only hops, in the manner in which I use them, and have, invariably, fine bright beer; yet I entertain the idea, that these necessary and pleasing qualities *may be obtained without them.* Still, they can do no harm; nay, I think they have a tendency to preserve the ale: but if the casks are drawn out, so as to leave them dry on its bottom, they will assuredly mould, and then cause that disagreeable result, "fustiness," which every brewer readily allows is very difficult to get rid of.

As my casks are upright ones, I never suffer them to be tilted, but draw them down to the tap, and then cork them up; by which means sufficient beer will be retained to keep the hops moist, and so preserve the casks very sweet. When I brew again, they are then drawn off close, by tilting them, and the beer reserved in a waste cask, for future use.

Adverting to what I have said, that fine, clear beer may be obtained without putting the hops into the

casks, permit me to state, I am greatly of opinion that the grand secret lays in the *fermentation.* If this is not properly effected, the beer, I am persuaded, will be cloudy; but if it is well cleansed in the gyle tun, and drawn off from thence by a tap, I am sanguine enough to suppose the object will be obtained.

I have lately brewed, and filled three casks, containing eighty gallons. The fermentation proceeded agreeably to my wishes. I added the flour and salt, as before, which greatly increased it. The beer worked but little in the casks; but what was thrown out upon their heads is as fine as brandy. I have put three or four handfuls of *wet* hops into two of the casks, but none into the third, in order to ascertain whether there is any, and what, difference.

Respecting *wheat* malt, I have to observe, that I have heard of it, but never saw any. I think it would produce, with barley malt, a sound and soft ale; but this is mere conjecture, arising from the circumstance of having several times used half a bushel of new bran in the mash tub with the malt; which certainly produces softness in the wort: but, similar to other benefits, it has its inconvenience, viz. that of bringing the beer to maturity sooner; consequently, the draft should be quick, or, by standing long on the broach, it will turn acid.

Having now, I presume, answered the inquiries of your correspondents, I will give you the remaining part of my method, which began in your Number 206, page 44.

Although I am very fond of Brewing, I find, after thirty years' practice, I don't relish leaving my bed at a quarter before four in the morning so well as formerly. I therefore contrive to get the water to boil before I retire to rest the preceding night: then throw empty sacks over the copper, shut the ash-pit door, and thrust in the iron slider across the chimney, leaving a small space for the smoke to pass off so long as the fire continues; by which means I can enjoy my soft slumbers till a quarter before six, when my man comes, at which time the water will be from 175 to 185 degrees by the thermometer, and we mash immediately, putting on about forty-six gallons to four bushels of malt. After stirring it well, I cover it up close, and let it stand one hour and a half; then draw it off by a tap in the front of the tub,—being far preferable to the common method of a basket and tap-ooze running underneath. The inside of the mash tub is fitted with a horse-hair strainer, which allows the wort to pass off very freely, and very fine.

My pails being marked at two gallons, the quantity is accurately ascertained. The first mashing generally produces thirty gallons. Mash again with thirty-six gallons, which may boil if required, as you cannot now scald the malt; but I generally take it at 185 degs. After stirring it well as before, it is covered up for another hour and a half, and then drawn off: the quantity will be the same as put on.

I mash for the last time with as much water at 185 degs. as I now think *I shall want to complete my quantity,* letting it remain one hour and a half, and then draw it off.* The quantity will not be less than put on.

When my first wort is drawn off, I put my hops therein, and wait until I have a sufficient quantity of the second wort to charge the copper with; by which means they become well soaked, and prepared for boiling.

I boil this charge one hour gently, with the copper lid on: and half an hour before I take it off, I introduce half the treacle (mentioned afterwards),

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* Violent boiling I conceive to be unnecessary; if the liquor boils gently, it produces the desired effect; viz. the extracting the virtue of the hops, which is the object in view. Excessive boiling occasions greater evaporation, and consequently greater waste of quantity, if not of quality, of the wort: more bitter may be extracted, but I am apprehensive it is at the expense of the saccharine properties of the liquor.

Three mashings of one hour and a half each, besides the time employed in stirring, will be quite sufficient to extract all the saccharine qualities of the malt; more time is unnecessary, and only calculated to draw out the bad properties of the husk, as I once experienced to my cost, the wort proving what the coopers denominate "eager," or approaching to sourness.

previously dissolved in a pail with some of the wort.

The second charge I boil two hours, under an idea that the virtue of the hops cannot be sufficiently extracted in less time. When it has boiled one hour and a half, I put in the remaining moiety of the treacle; and during the boiling of each charge, I invariably throw into the copper a good handful of salt, without regarding the observations of "*Globosum*," under the general opinion that it improves the liquor.

With what I stated in my former letter, I think I have now given you the particulars of my process; and should they be beneficial to any of your readers, I shall be gratified, having only to request, that should any inaccuracies or inconsistencies appear, they will be pleased to overlook them, as my other avocations prevent me from making the corrections I might otherwise be inclined to do. Should any further explanations be required, I shall be happy to give them.

Possibly some of your readers may be desirous to know the quantity of ingredients I use. That they may not be disappointed, I will describe them; observing that my object is to procure *a pleasant, clear, and wholesome beverage for general family purposes* (not strong ale); of course the quantity of water to each mashing must be reduced agreeably to the taste of the proprietor.

Winter Proportions.

4 Bushels malt.

4 Pounds hops.

12 Pounds treacle, or 10 pounds moist sugar, either of which are considered equal to a bushel of malt.

Summer Proportions.

4 Bushels malt.

5 Pounds hops, or 5½ lbs., according to the state of the weather.

20 Pounds treacle.

These proportions will make 80 gallons of very decent ale, strong enough for general purposes; but to ensure this quantity, I always allow one-fifth for water, which will require 96 gallons to be drawn off from the three mashings, which I prefer to *two of two hours and a half each*; because what remains in the malt after the third mashing will be very weak.

Suppose I require 80 gallons of beer, one-fifth will be 16+80=96.

$$\left.\begin{array}{l}\text{1st Wort obtained } 30\\ \text{2d Ditto} \ldots\ldots 36\\ \text{3d Ditto} \ldots\ldots 30\end{array}\right\}\text{96 gallons.}$$

If the boiling is rapid, and the *copper is uncovered*, one-fifth will *not* be a sufficient allowance for waste, as I have found by experience.

I am of opinion that treacle or sugar, particularly the latter, gives a mellowness to ale, independent of the spirit it contains,—particularly the latter; but the former imparts a fine nut-brown colour, much admired in my family.

I remain, Sir,
Your most humble Servant,
T. T.

St. Leonard's, Colchester.

ON THE COLOURS OF FLOWERS, AND ORIGIN OF METALS.

Sir,—In Number 217 of your work, I read an interesting article on the colours of flowers, which makes me wish that the writer would favour us with a further developement of his thoughts on that subject.

I have, for a long time, entertained an idea, that the colouring principle of leaves and flowers plays a very important part amongst the secretions and deposits of the outer skin of our old mother Earth. My contemplations and observations have led me to surmise, that the metals are formed by the vegetative process; being nothing more than aggregates and assimilations of the colouring matter of leaves and flowers, (which is well known to be metallic), percolating and accumulating near the surface of the earth. How many times any given ferruginous district must have had the benefit of the "fall of the leaf," in order to produce the present existing quantity of iron, is a question I think it prudent to defer, until I can get at the opinions of Messrs. Buckland and Banks, and other professors of the *lawful* geology. Having submitted my thesis on the formation of metals to the consideration of your readers, I will at another time submit a few rusty facts, for the elucidation of the subject, at least as far as relates to iron, which I take to be the most ancient and generally diffused of all the metals. We must not be startled, in certain disquisitions and calculations, by the mere number of places of figures. Mass, space, time, are in reality only terms of comparison. Our organic form is small, compared

to this globe; but our life is long, compared with that of some of the ephemeral tribe of insects, who, in a July afternoon, are born from out the waters at two, and have propagated their species, and given up the ghost, by seven or eight o'clock.

In No. 169, page 453, I have stated a fact concerning the oxidation of iron, which may be thought to have some connexion with the present subject. Another, which may fall in the way of most observers of nature, may be ascertained on the perpendicular sides of most chalk pits; where I have generally seen the roots of trees accompanied in their descent by a more or less abundant deposit of iron, which discolours the chalk, and even at intervals agglomerates into nodules of ponderous oxide. In ancient forest districts, as, for instance, in Italian Switzerland and Germany, the ganglions or nodules of ætitic and hematitic iron ores are disseminated throughout the soil, at a small distance from the surface, in a manner which appears to me somewhat indicative of the origin I am hinting at.

It would appear, the iron may be spontaneously assimilated and condensed from a gaseous into a metallic state. The ashes of plants which have been carefully grown without contact with any thing but the atmosphere and distilled water, are found to contain iron; and many undoubted specimens of *meteoric* iron are of considerable dimensions.

I am not yet prepared to say any thing about the formation of the other metals, except that I am inclined to look upon gold as a much more recent concretion than iron. Although the metallic principle is very analogous in all the metals, their oxides, however, produce very different and opposite effects, when applied internally to our animal structure. The oxides of iron are all astringent and corroborant; those of mercury are purgative; of copper, zinc, and antimony, emetic and poisonous; of lead, paralyzing; of arsenic, corrosive, &c. Nevertheless, the different metallic modes of matter are so far analogous in their principal features, that the long-dreamt-of transmutation of metals, or "*philosophers' stone*" of the olden chemists, is, perchance, by no means so far from being discovered as we are in the habit of supposing. Should these meagre hints, Mr. Editor, put you in the way of arriving at this great desideratum, I trust you will not, in your good fortune, forget your humble servant and constant reader,

F. M.

CEMENT FOR BOILERS.

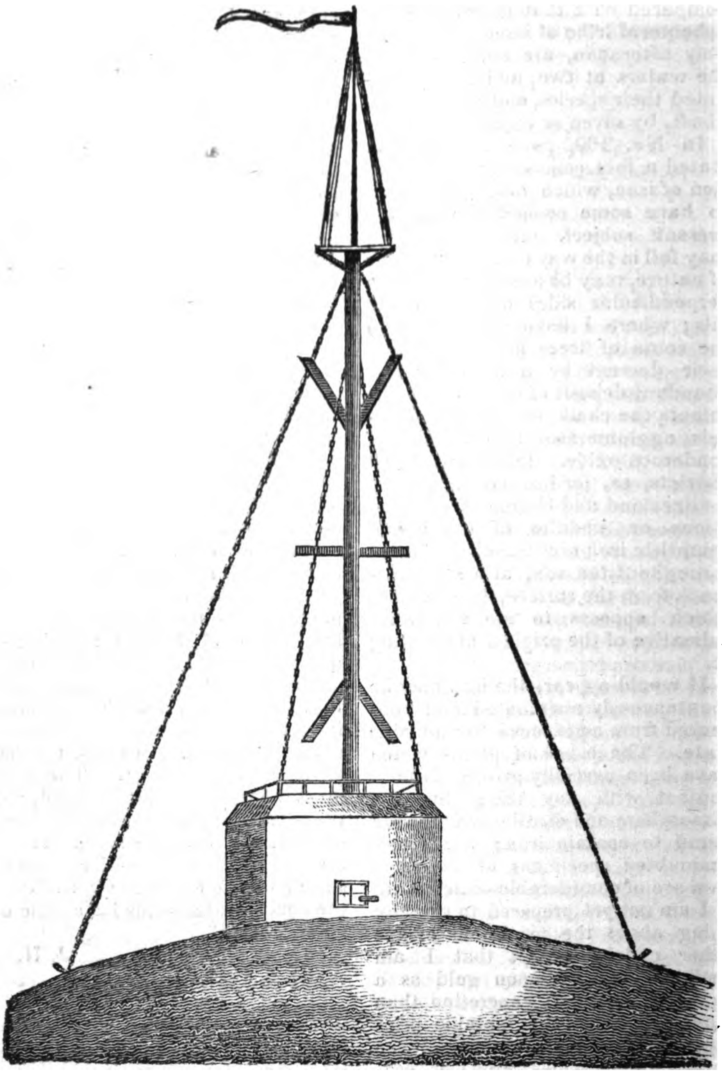
Sir,—Allow me to inform your different querists on this subject, of a cement which a friend of mine has used for a boiler. This boiler having cracked, he was advised (see Mech. Mag., vol. ii. page 111,) to make a cement of lime (made from oyster shells), worked into a paste with the white of an egg. The boiler has been in use upwards of ten years since the cement has been applied, and is now as firm as when first put on. I have myself frequently used it. When, in making experiments, a stream of gas, owing to some defect, has been issuing from an aperture, on which I could get no other cement to rest, this has effectually stopped it. The lime must be fresh and unslacked, and the cement applied as soon as mixed, otherwise it becomes solid. It is a cement which will resist the united action of fire and water; and even the concentrated acids have little or no effect on it.

J. H.

Oct. 3, 1827.

HOW TO PRESERVE BLACK-LEAD WRITING.

One of your correspondents wished to know how to preserve black-lead writing. Let him carefully do over the surface of the paper, after it has been written on, with milk and water, taking care it be skimmed milk, and he will fix his writing indelibly. *Probatum est.* FRS. DUBOIS.



A new system of telegraphic communication has been just established between the ports of Liverpool and Holyhead, which is remarkable both for the novel construction of the telegraphs, and the new purposes to which they are applied. The lines of telegraphs hitherto established in England and France (the only two countries in which this mode of transmitting intelligence has been yet introduced), have been wholly employed for government objects. We ought, perhaps, to except the line between London and Newmarket, which the well-known Richard Lovell Edgeworth established in 1767, to enable his eccentric and sporting friend, Sir Francis Blake Delaval, to obtain

early tidings of the fate of his turf speculations; but it existed for so short a time, and was employed to so limited an extent, that it may be considered as but giving an evanescent hint, how applicable this system of communication might be made to all sorts of purposes. The line of telegraphs which has commenced working between Liverpool and Holyhead, is undoubtedly the first which has been established for commercial and private correspondence, and for the common benefit of all who choose to avail themselves of it (with the restrictions afterwards mentioned). It owes its formation to the ingenuity and enterprise of Lieutenant Watson, and to the public spirit of the trustees of the Liverpool Docks, who have defrayed the whole expense (about £2000), and allow the use of it, gratuitously, to the owners, agents, and captains, of all vessels paying dock dues.

This line consists of ten different stations, viz. Liverpool, Bidston, Hilbre Island, Voel Nant, Llysfaen, Great Ormes Head, Puffins Island, Llaneilian, Gareglwyd, and Holyhead; keeping, it will be observed, along the coast the whole way—the weather being found more frequently clear in the vicinity of the sea than inland. The distance, in a right line, along these stations, is seventy-two miles; making the average distance between each, eight miles.

To enable the reader to appreciate the advantages of the new system of signals which Lieutenant Watson has introduced, it will be proper, before proceeding to describe it, to take a brief retrospect of what has been already effected in regard to telegraphic communication. It is but fair, however, to state, that for much of what follows, both as regards the history of telegraphs and as regards Lieutenant Watson's invention, we are indebted to that old and respectable country Journal, "Billinge's Liverpool Advertiser."

The merit of the invention of telegraphs applicable to universal purposes, belongs to Dr. Hooke, who, in 1684, communicated to the Royal Society the plan of a telegraph, which approaches the modern instrument in power, and nearly equals it in rapidity. His paper on the subject will be found in the 'Philosophical Transactions' for that year. He describes the distances of the stations, mentions the use of the telescopes, and suggests a set of characters to represent the alphabet, capable of being varied ten thousand ways. He also states, that 'none but the two extreme correspondents shall be able to discover the information conveyed.' He calculates, that the same character might be seen at Paris the minute after it was represented in London. His plan consisted in having boards of different shapes—square, triangular, &c.—answering to the several letters of the alphabet, hung up in a large square frame divided into four compartments. Each of these pieces of wood represented a certain letter, according to the compartment in which it was hung. Shortly after this time, M. Amontons, of the Royal Academy of Paris, published a similar project; and, by means of the scientific works in which both these inventions appeared, they must have been known to the learned over all Europe.

Nevertheless, it was not till about eighty years after this period, that any attempt was made to reduce the invention to practice. In 1763, Mr. Edgeworth, as already mentioned, constructed his private line of signals for Sir Francis Blake Delaval; and this, we believe, may be fairly considered as the first instance of the telegraph being brought into actual use, in modern times.* Mr. Edgeworth's apparatus transmitted sentences with great accuracy, from stations sixteen miles apart.

In the year 1794, M. Chappe invented a telegraph, for communi-

* The Editor of "Billinge's Advertiser" gives the French the credit of having first made use of telegraphs; but without any knowledge, apparently, of Mr. Edgeworth's claims.

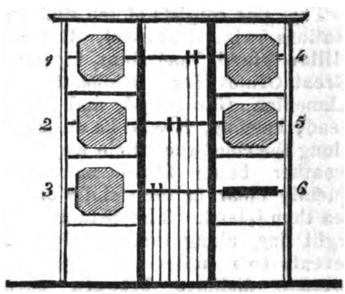
cating between the Convention at Paris and the French army in Holland. The French were at that time engaged in the siege of Lisle; and a line of telegraphs having been erected along the heights, the orders of the Convention were transmitted to the army in two minutes, and intelligence received of military operations in the same length of of time. The following figures represent the telegraph of M. Chappe. Figure *a* shows the machine at rest, and fig. *b* represents it in operation:

The machine, as will be seen from the figures, consists in an upright post, with a moveable bar of wood on the top, and at each end an arm capable of being drawn, by strings and pulleys, into many different positions. It admits of a very great number of positions and combinations; but the objection is made to it, that its movements are too complicated to be rapidly and correctly executed, unless by persons of great experience. Another kind of telegraph has been invented in France, which has three arms placed in three different parts of an upright pole or beam of wood; but it has not superseded the old one; which is obvious to every visitor of Paris, on the height of Montmartre.

In 1784, Mr. Edgeworth made public the plans (or an improvement of them) which he had realized in 1763, and strongly pressed them on general attention. His telegraph was a numerical one, consisting of four upright posts, with a wedge or cone moveable on a pivot at the top of each. This telegraph might be used either alphabetically or numerically, and the letters or figures were indicated by the positions of the wedges; but the instrument was objected to as being at once too complicated and too indistinct for distant vision.

The French invention was brought to England by the way of Frankfort, and immediately several plans, supposed to be improvements on it, were broached in this country. In the year 1795, the Rev. J. Gamble suggested two distinct plans: the first consisting in five boards of different lengths, placed longitudinally one above the other, and all moveable; and the other in an upright pole, with five moveable spokes or arms projecting from it, like the radii of a semicircle. Semaphores on this principle, though with fewer radii, were erected by the French along the coast of the channel in 1803.

In the year 1795, Lord George Murray invented, and offered to the Admiralty, the plan which was used by Government from that time till the year 1816. It was called the six shutter telegraph, and is represented in the following figure:—



These six shutters move on axes, and when turned edgeways to the spectator, as is the case with shutter 6, they are invisible at a distance. The letters, figures, &c. are indicated by the shutters being open or closed, that is edgeways or presented broad-side to the view. This telegraph is capable of making sixty-three separate and distinct signals; 24 of which stand for the letters of the alphabet (j and v being omitted), 10 for the Arabic numerals, 1, 2, 3, &c. and the 0, and the rest for the words most in use, as *admiral, captain, ship of the line, frigate, arrived, sailed, harbour,* &c., or, when used to communicate the operations of armies, the words *ge-*

neral, *regiment*, *camp*, &c. Lines of telegraphs on this principle were established from London to Portsmouth, Plymouth, Deal, Yarmouth, &c. The plan was to spell all the communications by means of the alphabet: but the stenographical principle was adopted, of putting only the consonants, with the initial and final vowels, and occasionally one in the middle of the word, as *Agmemnn* for *Agamemnon; Invncble*, for *Invincible*, &c. Short words, as, *the*, *of*, *to*, &c. were frequently omitted; and the news compressed into as few words as possible.*

In 1807, Captain (now Colonel) Pasley published a plan of an instrument, which he called a *polygrammatic telegraph;* and which consisted in two arms fixed on the top of a pole, and turning on one pivot. He afterwards proposed to multiply its powers, by having four poles, with two arms each; and finally, he suggested the placing three pairs of arms on one pole. This last plan comes extremely near the kind of telegraph adopted by Lieut. Watson in the Liverpool and Holyhead line, and which will be afterwards explained.

Lieut.-Colonel Macdonald paid great attention to the subject of telegraphs, and published his speculations in 1808. He preferred the shutter-telegraph, and even proposed to make the number of shutters thirteen, instead of six: but this would greatly increase the indistinctness which was the fault of the old Admiralty telegraph. He has the merit of strongly urging the abandonment of the spelling system, and the adoption of the numerical system in connexion with a dictionary of words; the latter plan admitting of many thousand words being conveyed by the machine.

In 1816, Sir Home Popham proposed the semaphore, of which we have given a particular description in our 4th volume, page 385. It being found, after many trials, that the arms of the semaphore were undeniably better seen, at a distance and in hazy weather, than the shutters of Lord George Murray's telegraph, it was adopted instead of the latter by the Admiralty, and is the only machine now used by Government. The semaphore is capable of making forty-eight distinct signals; the lower arm has six different positions, and the upper seven. The plan of communicating messages by spelling is still continued, and, so long as this is case, the simpler the machine the better it will be. This semaphore is also capable of conveying words and sentences, if the numerical system were applied to it; but, from being incapable of expressing more than one figure at once, this plan would be nearly as tedious as spelling.

Construction of Lieut. Watson's Telegraph.

The telegraph of Lieut. Watson, as represented in the engraving prefixed to this article, consists of a mast of Baltic timber, 50 feet high, and 22 inches in diameter (including the oak fishes or slabs girt round it with iron hoops); it is stayed from the top by four strong chains fixed into the rock. There is also a top-mast 27 feet high. In the principal mast are fixed three pairs of arms, moveable by pulleys and halliards* playing in grooves cut through the centre of the mast, and worked from a small observatory built round the foot. The arms are

* It is of some consequence, on this plan, to place the most important words first, owing to the suddenness with which fogs sometimes come on in the midst of an operation. A curious illustration of this is given. During the war, the London telegraph received from Portsmouth one morning the words—"*Wellington defeated*"—when a fog rendered the rest of the message invisible. Great suspense and alarm prevailed through the day, till, on the clearing of the atmosphere, in the evening, the whole message was received—"*Wellington defeated the French,*" &c. It would have been better —"*The French defeated by Wellington,*" &c.

* The halliards are made partly of chain and partly of rope; the lower part is of rope, which is made as short as possible, from its liability to be affected in length by the weather.

of African oak, painted black, and measure 7 feet 6 inches long by 16 inches wide; when not extended, they fall into the grooves of the mast, and are invisible.

Each of the three pairs of arms is capable of assuming six positions, with only one arm extended at once, viz. 1st, an oblique inclination upwards at an angle of 45 degrees; 2d, a horizontal position; and 3d, an oblique inclination downwards. Three other positions are assigned for each pair, which require both the arms to be extended at once, as is shown in the drawing.

This telegraph is adapted to the *numerical* system; that is, all words, names, sentences, &c. are expressed by numbers or figures previously arranged in a printed vocabulary. It is also as capable of *spelling*, when a proper name or uncommon word should occur, as any other telegraph. The numerical system may be briefly explained. Each number, as we have said, is made to signify a certain letter, word, or sentence, according to a fixed system. The first 26 numbers signify the *letters of the alphabet;* 1 signifies A, 2 B, 3 C, &c. The numbers from 27 to 58 are appropriated to the *points of the compass;* 27 signifies North, 28 N. by E. &c. The numbers from 62 to 185 are appropriated to portions of *time*, from a second to two years, and including the hours of the day, and days of the month. The numbers beyond this, to the extent of more than seven thousand, are appropriated to a vocabulary of words and sentences, which will be best understood by the following specimen from the work Lieut. Watson is about to publish:—

No.
186 A.
187 ABACK.
188 Heave all *aback*.
189 Taken *aback*.
190 ABAFT v. AFT.
191 *Abaft* the beam.
194 ABANDON, s, ed, ing, ment.
195 *Abandoned* by the crew.
196 Do not *abandon* the vessel.
198 ABATE, s, d, ing, ment.
202 The storm *abated*.
211 ABOARD.
212 All *aboard*.
213 A pilot is *aboard*.
214 Send *aboard*.
373 AFLOAT.
374 *Afloat* abaft.
375 *Afloat* forward.
376 As soon as she is *afloat*.

After the vocabulary comes a list of *merchants' names*, to the number of some hundreds, each of which has its several number in the printed work. Then follows a *gazetteer*, including many hundreds of seaports, towns, and countries. And last of all come the *names of vessels* belonging to or frequenting the port of Liverpool.

It may seem difficult to express with certainty so many different numbers by the telegraph; but, when explained, the process is quite easy. The total number of distinct words, names, &c. in the vocabulary, is nearly 10,000, which are divided into classes of 999 each. Now, the telegraph can express any number from 1 to 999 at a single operation. It has been seen that each pair of arms is capable of nine positions, and to these positions the figures from 1 to 9 are determinately affixed. It is then arranged that the uppermost pair of arms indicate *hundreds*, the middle pair *tens*, and the lowest pair *units*. Thus, suppose one of the upper arms to indicate 2, the middle arm 5, and the lower arm 3, the number is 253: suppose the upper pair to indicate 7, the middle pair 8, and the lower pair 9, the number would be 789. A cypher or 0 is not needed, because the absence of any movement in the middle or lower arms would sufficiently indicate the cypher. Suppose No. 1 to be extended in the upper pair, without any indication in the pairs below, the number would be 100: suppose No. 1 to be extended in the middle pair, without any indication either of the upper or lower pairs, the number would be 10.

But as the telegraph will only express three figures at a time, the number indicated cannot be above 999. To increase the powers of the instrument, therefore, *nine* different *classes* are made, each of them containing 999 numbers. The signal-

man, in making his signal, indicates in the first instance, by the upper pair of arms, *of what class* the number is which he is about to express. Suppose he says Class 1. No. 195: this is found, on referring to the vocabulary, to signify 'Abandoned by the crew.' And so of all the other classes. By the use of combinations, such as are employed in the Admiralty Semaphore, this telegraph might express any number, however large; but Lieut. Watson thinks it better to avoid the use of these combinations, as they are not necessary in a machine so comprehensive as his, whilst they make the operations much more complicated.

The signal-man at each station is continually on the look-out for signals from the next telegraph. When he sees the first signal, he makes a signal himself to show that he perceives it; and then, going to the ropes by which the machine is worked, he repeats the signal to the next station. If the message should consist of more than one signal, as is generally the case, the first is repeated before the second is made; and thus, if the message should contain nine signals, the first part of it would be in Liverpool at the time that the last part left Holyhead. Although the signal-man does not see the arms of his own telegraph move, from being in the small house immediately beneath it, yet he has not the least difficulty in operating with precision. At the end of each halliard is an iron weight, which just balances the arms; and in this weight is a bolt, which fits into holes made in the mast at those exact points where the halliard should be pulled to, in order to raise the arms to the required positions. To render the telegraphs available for communicating with vessels along the coast, the mast can be turned round, so as to present the machine broad-side to the sea.

This brings us to the system of communicating between vessels at sea and the telegraph. For this purpose a series of nine flags is used, so differently coloured as to be easily distinguishable. Each of these flags represents a number or figure, from 1 to 9, and three of them, displayed at once at the main-top, one above the other, will indicate any number up to 999. By hoisting a signal on the fore-mast to indicate the *class*, it is obvious that as many numbers can be represented as by the land telegraph. If a vessel in distress were to hoist the signal of Class IV. on the foremast, and 816 by three flags at the main-top, the signal-man at the telegraph would look at the vocabulary, and instantly find that Class IV. No. 816, was—"Has sprung a *leak*." No. 818, under the same class, would signify —"*Leak* increases, and is dangerous." The answer might be given, Class 1. No. 196—"Do not *abandon* the vessel;" followed by Class VII. No. 83, and Class VI. No. 334, which together signify—"A *steam-boat* is gone to *relieve* the vessel in distress."

The chief purpose to which Mr. Watson's line of telegraphs is at present applied, is to report, first, the state of the wind daily at Holyhead; second, the vessels passing that place outward or homeward bound; third, the state of any vessel in distress, or in need of assistance, along the whole intervening line of coast; fourth, any important information, either political or commercial, from Ireland or America—made known in the latter case at Holyhead by the signals of homeward-bound vessels. But there are various other purposes which these telegraphs may be made to answer. The difficulty is to say what kind of correspondence they may not serve to conduct. We know not, indeed, that it will deprive the post-office of the love-letters which now pass through it, though we see no reason why it should not. On the contrary, its swiftness is admirably adapted for the communications of impatient lovers.

——'Love's heralds should be thoughts;
Therefore do nimble-pinioned doves draw love,
And therefore hath the wind-swift Cupid wings.'

So said sweet Juliet; and had she had a telegraph, it would have made

her happy, and spared her nurse's bones; nay, it might have saved the life of her Romeo. A sigh or a vow might be wafted from London to Bath or Cheltenham in a few seconds: a lover might thus most conspicuously *signalize* his devotion to the fair one of his heart; and the pining mistress might learn from the expanded *arms* of the telegraph how soon she should be restored to the arms of her betrothed. We dare to say that Lieut. Watson will assist any couple about to endure the pangs of absence, to adapt a Cupid's vocabulary to his telegraph. Nay, we shall show them by and bye how they may do it without his assistance, and with such secresy that the tenderest breathings may be conveyed under an impenetrable cypher. Paper may be violated, wax may be melted, but a telegraphic love-letter would be more mysterious than the enigma of the sphynx, as well as swifter than the flight of 'Venus' doves.'

At all events, every kind of commercial intelligence might be conveyed with certainty and secresy by this method. The two correspondents, being each provided with a vocabulary, have only to agree to add a certain number, say 5, 6, or 7, to the numbers given to the signal-man of the telegraph, and thus it would be impossible for him to understand a word. Instead of 381, the No. 386 might be given; instead of 260, the No. 265; and the correspondent at the other end, knowing that he ought to deduct 5 from each number, would immediately discover the meaning. Even more intricate methods will easily occur to every one. Between such towns as Liverpool, Manchester, Leeds, Hull, Birmingham, and London, this species of communication would be highly valuable.

In time of war, the utility of the telegraph from Holyhead to Liverpool would be extremely great. No enemy's ship or privateer could approach any part of the coast, without its being instantly known at every station; and all kinds of important intelligence might be conveyed with the same rapidity.

It seems very probable that many improvements may yet be made in the telegraph, to adapt it more entirely to every species of communication; though to us it appears to be already greatly simplified in the system we have described, and capable of being almost universally applied.

CHURCH CLOCKS.

Mr. Editor,—I had not seen any remarks on the performance of the church clock at Boston, when I addressed you, (see page 546, vol. vi.); and therefore I am wholly innocent of the charge surmised by Mr. Wynn, (page 202, vol. vii.) of wishing to claim a superiority in behalf of any other clock or clock-maker. I have no desire to recommend one, or depreciate another. With respect to the observations on St. Mary's clock, Cambridge, they were made by a member of St. John's College, with considerable care and attention, and during a period of several months. As to the observations on the clock in the tower of York Minster, I have resided for some years within a few hundred yards of that building, and have attended to the performance of the clock almost daily; obtaining my time from solar observations.

This clock was set on the 22d March, 1827; and its greatest error between that time and 20th September amounted to about a minute, which was corrected by putting it forward a minute on that day. From the 20th September, to the 14th November, the greatest variation from time has not amounted to twenty seconds. The tower in which the clock is placed is lofty, and exposed to the westerly gales; the peal of bells is ten in number: on three of them the clock strikes. The peal is of the same weight as that of Bow Church, London. If the rocking of church towers, from the ringing of bells, and from the force of hurricanes, were the cause of material error, it is reasonable to conclude that, in a period of six

years of observation, this clock would have been perceived to be in some degree affected. Yet it has not been the case. The bells are frequently rung, and heavy gales have occasionally damaged the fabric and the neighbouring buildings without any perceptible effect upon the performance of the clock.

That the clocks of churches vary considerably from one another as to time, I admitted; but I stated that, in repeated instances, I had traced the cause to the ignorant or negligent manner in which the clocks were kept. Mr. Wynn attributes it, in those clocks which have dials, to the action of the wind on the hands; and in those which have none, to the shaking of the towers by gales of wind and by bell-ringing; but not a single fact is adduced in proof of these assertions. On the other hand, I have adduced instances of two clocks, one with a dial exposed to the west, the other without a dial, both of which perform with great accuracy, and without being affected by the alleged concussion of the towers.

I consider your publication as intended to serve the interest of science, and not those of individuals: and I conceive that before your readers come to the conclusion that the want of punctuality in our church clocks is only to be remedied by substituting clocks of Mr Wynn's manufacture, this gentleman must first establish the fact that concussion is evidently the cause of the enormous errors which are too commonly observed; and must next explain the nature of his remedy for the evil; that the public may benefit by his discovery.

J. G.

LONDON MECHANICS' INSTITUTION.

Mr. Editor,—Amongst such of your correspondents as have attended to the condition of the roof of the Lecture-room of the Mechanics' Institution, not one appears to have urged that which I should conceive to be the most cogent argument in favour of the propriety of calling a special general meeting—the opportunity such a meeting would afford of discovering who ought to pay for the repairs of the roof. The very low state of the funds of the Institution renders this point too important to be overlooked, or not to be of the very first consideration.

From the palpable disinclination evinced on the part of the constructor, or constructors, of the roof, whoever he or they may be, to give explanation of the matter, it is but fair to conclude that there is something which would ensue upon such explanation that would not be at all to his or their interest; this, however, should only make the Committee more active in finding out the real offender (if indeed he be not already known), in order that the saddle of expenses may be fitted to the right back.

I beg leave to say that I entirely agree with your correspondent ☞ in his remarks upon the repetition of Mr. Wallis's Lectures; and also to add, that I think such garish lectures are adapted as much for the purposes of attraction and the consequent addition to the funds, as for the real instruction of its members. It is to be regretted that the Institution has placed itself in such a situation as to render such, amongst other expedients, necessary for the supply of funds for its ordinary purposes.

I am, Sir,
Yours very faithfully,
AURUM.

Nov. 13, 1827.

FOOTING STOCKINGS.

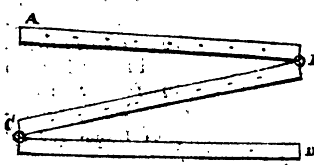
Sir,—As Mr. Peede's inquiry (No. 217, page 221) is imperfectly answered in No. 220, of Saturday last, I shall attempt a more satisfactory one. Stockings can be refooted either by frame or knitting pins, (only stockings originally wrought by the hand, cannot be done on the frame, having no seam behind, and so cannot be opened to be fitted on it.) In Scotland this practice is quite common: the peo-

ple who do it keeping yarn of every shade and colour to match the old legs; the ordinary charge is about half the original cost of the stockings. I am astonished how a "Frame-work Knitter" could assert that "footing stockings on the machines would cost more trouble than making new ones. I have seen it many times done, and never saw any apparent difficulty attending it. I have little doubt but those who are expert at this very economical branch of the trade, would meet ample encouragement in London; and have scarcely a doubt, but the observations Mr. Peede's inquiry has elicited, may be improved to real advantage by some who might not be aware that such a practice had yet to be introduced into the metropolis.

I am, Sir,
Yours,
W. CROSBIE.

NEW PLAN OF MEASURING A BASE LINE, &c.

BY WM. SHIRES, MATHEMATICAL TUTOR.



In lieu of Metal, let Gunter's chain be made of wood, because wood will never alter in length, either by heat or cold, wet or dry. Let the chain consist of twenty staffs, A B, B C, C D, &c. each five links long; and let it be made to open and shut by hinges C and B, &c. The end of the staffs shall touch each other, and, when shut up, they will form a body like a board. (For a great survey, the chain may be made much longer.) To measure the base line, let it be measured on ice; and if you would find the magnitude of the world, measure a line directly north or south, from some one station, to a distance of sixteen or twenty miles, marking the ice at the end of each measure with a knife: so in the whole measure you would not be out half an inch. This measure should be performed betwixt the latitudes of forty and fifty degrees; both on account of the world being an oblate spheroid, and because ice of great extent may be found in these regions, as, for instance, about the American shores. Now, at the ends of the base so measured, observe the meridional altitude of some one fixed star, *i. e.* when culminating; and take the difference of those altitudes, and it will give the angle which your measured base subtends at the earth's centre; then state, as the angle so found is to 360 degrees; so are the miles measured, to the miles on the whole meridian of the earth.

Note.—The steel chain, with which the great survey in England was made, must have been about five inches longer in a hot day, than in a cold one; nor will you ever measure far enough on land correctly, by reason of its unevenness. It were as absurd to expect to do so, as to seek the distance of the sun by help of the transit of Venus over the sun's face; forgetting that you are seeking a parallax from that which of itself has a parallax, and which, therefore, would but find those proportional distances which are otherwise known.

NOTICES TO CORRESPONDENTS.

Mr. Seers' letter in our next.

The letters which miscarried last week, will now be found at our Publishers.

Communications received from Mr. Baddeley—G. M. J.—Amateur—W. L.—F.—John Hugill—O. G. L.—X. X.—Semper Idem.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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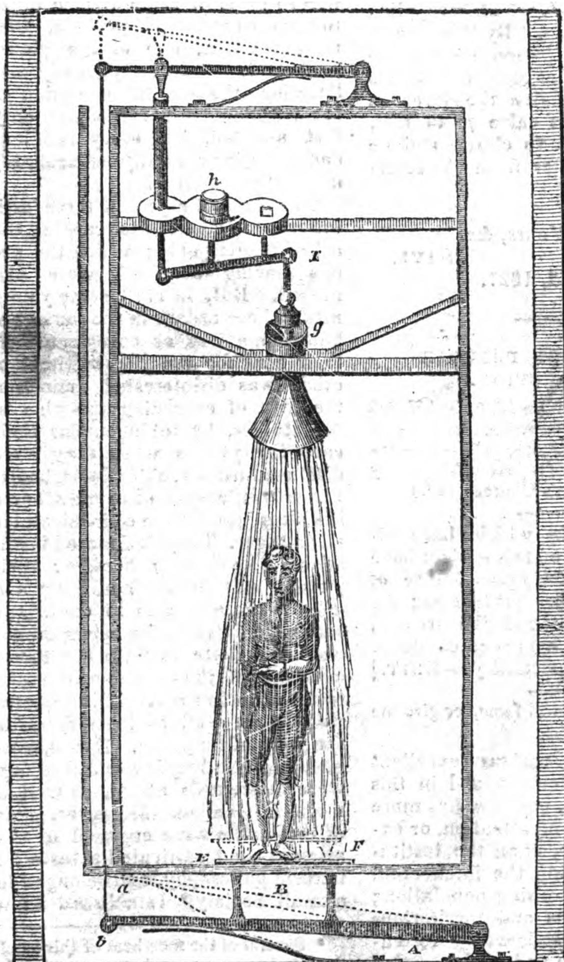
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 223.] SATURDAY, DECEMBER 1, 1827. [Price 3*d*.

IRON is the source of GLORY, for it supplies the soldier with his sword; of PLENTY, for it provides the husbandman with his ploughshare and pruning hook; of COMMERCE and CIVILIZATION, for it furnishes the mariner with his compass.

SELF-ACTING SHOWER BATH.



SELF-ACTING SHOWER BATH.

Sir,—The construction of the self-acting shower bath, represented in the prefixed drawing, will, I presume, be easily understood. A is a spring board fixed below the floor. At *b* the wire is fixed to the spring board that is to work the lever *c*. The figure D, or person, is standing on the stand E, which presses down the spring board A; and as soon as D steps off, the stand rises to the dotted line F: the valve *g* then closes, and the valve *h* rises, and the water is again let into the reservoir I from J, which is supplied by a forcing pump. By this means, as soon as the person steps on to the stand in the bath closet, his weight brings down the lever *c*, which causes the valve *g* to rise, and the valve *h* to close, and he receives the water from the reservoir.

I am,
Yours, &c.
M. SAUL.
Lancaster, Oct. 2, 1827.

HISTORY OF POPULAR INSTRUCTION.

(*Abbreviated from "An Historical Sketch of the Origin, Progress, and Present State of Gas Lighting,"* by WILLIAM MATTHEWS; just published by Hunter, St. Paul's Church-yard.)

[All the works which have hitherto appeared on this subject have had a disgraceful intermixture of quackery and false pretension; we can safely recommend the present, as distinguished by great candour, honesty, and impartiality.—EDIT.]

" Oh! give me honest fame, or give me none."

Amongst the various excellent plans of education pursued in this country, not one, perhaps, has more deservedly received attention, or excited admiration, than the institutions for supplying the intellectual wants of its labouring population; and how zealous and meritorious have been the endeavours to enlighten this large and useful portion of the community! Some benevolent and patriotic individuals very early engaged in this noble career of improvement, and contributed to spread its cheering influence at Birmingham; and a few rays of light will perhaps be thrown upon this interesting topic by the following relation of facts, which evince how successful and long-continued have been the exertions in that town to accomplish this important object.

Though Sunday-schools originated with the beneficent Mr. Raikes, of Gloucester, their utility was so evident, as to induce other towns soon to introduce them. Birmingham was one of the places where this benevolent plan of ameliorating the mental condition of the working classes was not only first adopted, but every religious denomination cordially and zealously united to support it.

The original object of these institutions was confined to teaching the art of reading only; which the pupils having acquired, were dismissed. But, in 1789, some young men, whose ardour in the pursuit of knowledge was as conspicuous as their zeal for the improvement of others was disinterested, conceived the idea of extending the plan of Mr. Raikes, by taking under their care the youths when they were dismissed from the Sunday-schools; and this enlargement of the scheme has been productive of incalculable advantages. They designated themselves *The Sunday Society*: their purpose was to teach *writing* and *arithmetic*, and also to contribute such other information as would not only contribute to form the moral character of the boys, but be useful to them in their several future occupations, as well as keep them in the paths of rectitude. Hence, *geography, book-keeping*, and *drawing*, were afterwards added, as well as moral instruction. Moreover, some of those who were engaged in this attempt, had cultivated a taste for natural philosophy, and belonged to a small Society,* established a few

* Several of the members of this small Society became conspicuous characters

years before, for their mutual improvement in useful knowledge; and as some of them were skilful and ingenious as workmen, they constructed a variety of apparatus for experiments to illustrate the principles of *mechanics, hydrostatics, electricity, pneumatics*, and *astronomy*.

This Philosophical Society also possessed a well-selected, though not a large library, consisting principally of works on scientific subjects; and they permitted the reading of their books, by others unconnected with them, upon the payment of a small subscription. Some of its members likewise occasionally gave lectures on the above subjects, to *the young men and others connected with the manufactories in the town;* thus gratuitously communicating scientific information, and probably creating a taste for it in a larger circle. Hence, the disposition to such pursuits was widely spreading in the town; for the various individuals belonged to different manufactories, and they were ardent and active in promoting the success of such schemes.

The unfortunate riots at Birmingham, in 1791, at length occasioned a temporary interruption to these useful and meritorious efforts to promote the improvement of the artizans of Birmingham.

* * * *

But the ardour of the Sunday Society for the attainment of their objects remained undiminished, and, in 1792, they resumed their plans, and pursued them with increased earnestness. In 1796, the Society underwent some modifications, and changed its name to "The Brotherly Society." The following is one of the rules which they adopted on that occasion; and it will not only explain the extended objects of the new association, but evince its near resemblance to that of the present *Mechanics' Institutions*:—"The objects for improvement shall be Reading, Writing, Arithmetic, Drawing, Geography, Natural and Civil History, and Morals; *or, in short, whatever may be generally useful* TO A MANUFACTURER, *or as furnishing principles for active benevolence and integrity*." Mr. James Luckcock, who was one of the first to engage in this project, delivered a series of Moral Lectures to this Society, which he afterwards published under the title of "Moral Culture." The admission to the lectures was gratuitous, and they were very numerously attended by persons of both sexes.

The disposition to promote the spread of knowledge, at this period, in Birmingham, is shown by another important circumstance. This was the establishment of a *Library for the peculiar Use of the Working Classes*. This originated with Messrs. Thomas and Samuel Carpenter (the brothers of Dr. Lant Carpenter), who had established a Sunday-school, which they conducted by their own exertions, and supported at their own expense. Mr. Thomas Carpenter also occasionally gave lectures gratuitously on some useful subject, *to the younger artizans*, at his own large room.

* * * *

From the preceding detail, it will be evident that the origin of the several plans for giving useful information to the artizans of Birmingham, belongs to Mr. James Luckcock, and a few of his associates in

in succeeding years; one of them is now a distinguished Royal Academician, and also one of the Council of the Royal Academy; and at a time when they were attending to Hartley's Theory of the Mind, their President was the highly respectable, acute, and intelligent Principal of Hazlewood School. Another member of this Society, Mr. Thomas Clarke, was also one of the persons who early engaged in the instruction of the *working classes;* and he was accustomed to give familiar lectures at his own house *on Mechanics and other branches of Natural Philosophy, to* A NUMBER OF ARTIZANS; and, among others, several of the workmen belonging to the Eagle Foundery. This was in 1794 and 1795; and one of his numerous acquaintance designated this assemblage as "the *cast-iron philosophers*."

the town.* Their labours in this great and good work have been unremitting for a very long period; and thousands can testify to their successful effects. *They commenced many years before Dr. Birkbeck delivered his lectures to the mechanics at Glasgow, and of which the public did not hear till nearly twenty years after they were delivered.* But as so much has recently been said and written about the origin and utility of Mechanics' Institutions, ought the great, but modest and disinterested, services of James Luckcock and Thomas Carpenter, and their associates, to pass unnoticed, when their exertions have been so remarkably mentioned?

There is not another individual existing, to whom the friends of *general education* are under greater obligations than to Henry Brougham, Esq., who, amidst numerous avocations, and the distractions of a laborious profession, has steadily devoted his attention to the subject. His able and eloquent appeals, his energetic and indefatigable exertions, have produced effects, and given rise to establishments, whose advantages will be more duly appreciated by posterity. Future ages will revert to, and ruminate upon, his pre-eminent services to his country with grateful admiration, and will rank him amongst the greatest of those who benevolently and disinterestedly endeavoured to elevate the character of man. Had he known of the beneficial labours of James Luckcock and Thomas Carpenter, and their coadjutors, at the time he wrote his "Practical Observations upon the Education of the People," his candid, and manly, and generous spirit, would have deemed them of too much importance to pass unnoticed. But, from a note in that useful and interesting address, it appears that he derived his information respecting Dr. Birkbeck's scheme, from a letter of Mr. D. Bannatyne, which appeared in the Mechanics' Register;* and he states that, as early as 1817, the latter gentleman had recommended an extension of Dr. Birkbeck's plan, in Mr. Napier's Encyclopædia. The Moral Lectures of Mr. Luckcock were published *at the beginning of* 1817; they were printed in 1816, and the preface is dated December in that year: at the end of his work he gave a concise account of the origin, progress, and success, of the plans which had been formed for the education of the working classes in Birmingham, *for thirty preceding years.* However obvious and well known as they were in that town, all these circumstances *might* be utterly unknown to Dr. Birkbeck.

But the following facts, though known but to a few, may, perhaps, be considered as rather striking, when connected with others of a more recent date. About the year 1804, Dr. Birkbeck delivered a course of lectures on chemistry, by *subscription*, at Birmingham; and a very respectable individual, who was peculiarly ardent, active, and persevering in scientific pursuits, and also very earnest in his endeavours to diffuse a taste for them among the artizans within the circle of his acquaintance, *voluntarily* and *gratuitously* assisted Dr. Birkbeck for some weeks in preparing and making the experiments exhibited in these lectures. This person was one of those who had acquired his taste for this kind of knowledge by casually attending some of the lectures which have been before alluded to; and he was moreover *the coadjutor of Mr. Luckcock*, in the management of the largest manufactory of its kind in the town of Birmingham. Besides, this very individual was an evidence of the attainments of a person who had devoted a part of his leisure only to scientific subjects; he could hardly be excelled in the elegance and skill displayed in the construction of his own apparatus, and, as

* From the preceding detail, and especially from the note in the preceding page, we should have concluded, that Mr. Thomas Clarke, rather than Mr. Luckcock, ought to have held the first place in this honourable list.—*Ed. Mech. Mag.*

* Mechanics' Magazine, No. 73, Jan. 15, 1825.

an experimenter, he was at that time far superior to Dr. Birkbeck. From the zeal which the latter has exhibited in London, in promoting the establishment of Mechanics' Institutions, is it to be presumed that he could be in almost daily intercourse with such a character as the above, in a town where its numerous manufactures abound in chemical preparations, and not make any inquiries respecting the means employed for instructing the working classes of Birmingham? If he did *not* inquire, would it not argue a want of curiosity in a person professedly so zealous for the instruction and improvement of mechanics? And, if he did inquire, did he obtain the satisfactory information which would be entitled to notice? *Not a syllable, however, has ever publicly transpired upon the subject*, and therefore—it must be inferred that nothing was known. These remarks are not made with a view to depreciate the valuable labours of Dr. Birkbeck; but, do not justice and candour imperiously dictate the assertion of the *prior* and *superior* claims of James Luckcock, Thomas Carpenter, and others in the town of Birmingham, *to the establishment of institutions for the education of the working classes?** It is a pleasing reflection, that, excepting one person (Mr. Thomas Phipson), all those who so zealously and disinterestedly engaged in this noble work of enlightening *the working classes* of Birmingham, still live to enjoy the ineffable gratification of witnessing the effects of their own benevolent exertions to benefit society. Unostentatious as were the labours of this little band of patriots, they have been strikingly effective, and eminently entitle them to the respectful and grateful attention of their country. What the writer of this has stated respecting Dr. Birkbeck's Lectures at Birmingham, is from his own personal knowledge; for he was on that occasion one of his hearers, and also intimately acquainted with the other individual alluded to.

* The writer has overlooked that there is yet another claimant to this honour, Dr. James Anderson, of Glasgow, who *founded* the Institution in which Dr. B. first became a lecturer to mechanics.—*Ed. Mech. Mag.*

MR. WRIGHT'S CRANE.

The Editors of a contemporary Journal (the "Register of Arts") have thought proper to apply to themselves the appellation of "dogmatizers in science," used by us in our 220th Number, when speaking of those who, in spite of ascertained facts, persist in denying the merits of Mr. Wright's new crane; and to prove how much they are entitled, by their habitual modesty and discretion, to a more enviable sort of distinction, they pronounce what we have said of Mr. Wright's crane to be "a tissue of absurdities," at variance with "the first principles of physical science," and founded on facts either not witnessed by us, or by us alone; and this, without either establishing a single absurdity against us, or even attempting to convict us of a single misstatement!

We asserted that "*both power and velocity are gained by the new combination;*" and to prove this absurd, the Editors of the "Register" ask us if we mean to "dissent from the proposition, that *no power can be gained by machinery, but at the expense of velocity?*" Our readers will perceive at once the utter dissimilarity between the two cases. In the former, one combination of mechanical powers is spoken of, as contrasted with other combinations—the new crane with the old cranes; in the latter, the "machinery" that loses velocity as it gains power, is but one sort of machinery, differently applied. Suppose we had asserted that a man could exert greater force with a screwdriver than with a stock-bit, would these sapient Editors have thought to cover us with confusion, by asking—Do you mean, then, seriously to assert, that a man of sixteen stone weight can ride faster on a horse than on a donkey?

We are next charged with "either describing what we did not see, or seeing what others did not," on the occasion of the trial of Mr. Wright's crane. But of this serious insinuation no proof whatever is offered. We defy them to produce any.

The "most remarkable part" of our statement is said to be "that a man, (by turning a roller with a handle, can do only half the work which he can accomplish when assisted by the wheels and pinions of the common crane." And how do they disprove this? By asserting it to be a well-known fact, "that a man, with a simple roller and handle, can raise a *greater* weight in a given time, than with all the additional assistance afforded by the wheel and pinions of the common crane." "A *greater* weight IN A GIVEN TIME!" Mark here, again, reader, the honesty and ingenuousness of these editors! Our statement, as must have been evident to every one who read it, referred to work done *for a daily continuance*: they refute it, by showing what can be done in *a given time*—in five minutes, for example, or an hour! If their objection were good for any thing, it would go to this extent—that cranes are good for nothing!!

It is said afterwards, in more specific terms than any yet quoted, that we have asserted "that both *power* and *speed* may be gained by *increasing* the parts of a machine." A wicked misrepresentation! We never made any such assertion, nor said any thing that can bear such a construction.

From the *manner* of this attack, (parts of which are even more *unmannerly* than any we have quoted) it is hard to believe that a desire for *truth* can have formed any part of the object aimed at by its authors. What then? Can they have any sinister purposes to gratify? Does our success as journalists offend them, that they seek, by false accusations, to depreciate us in public opinion? Or, can it make any difference in their estimate of the labours of the Editor of the Mechanics' Magazine, that one of them happens to be a leading member of that body, whose conduct in the management of the London Mechanics' Institution it has so often fallen to the lot of this work to censure and expose? We leave it to the candid and impartial to judge.

MR. HOOKEY'S AND MR. WEEKES'S IMPROVED RUDDERS.

Sir,—Having been the means of originating a discussion on ships' rudders in your Journal of the Arts, in a letter on their improvement, signed "A Friend to the Mechanics' Magazine," in No. 209, I beg to make a few observations, which appear to be called for, on the point in question.

It is with much pleasure I perceive that, in addition to an answer to my letter from Mr. Hookey, in No. 218, Mr. G. Bayley, and another ship-builder, signing himself W. Y., in 219, have favoured us with their accounts of the subject; as nothing is more gratifying to me than clear explanation and investigation, in order to discover the truth.

The dispute as to the claims of Mr. Weekes and Mr. Hookey to the improvement in the heel of the rudder, for preventing ropes getting between it and the stern post, now adopted generally with such advantage to the Navy, at the suggestion of Mr. Weekes, naturally divides itself into two inquiries: 1. Did Mr. Weekes copy the whole or a part from Mr. Hookey? 2. Since there is a difference in their two plans, which is the best?

1. As Mr. Hookey's "Friend" appears to intimate that Mr. Weekes borrowed his plan from him, whereas the latter gentleman avers the contrary, it is proper to look into the grounds of the aspersion; and if we do so, I am sure we shall not know which to wonder at most—the want of discernment, or the unfairness displayed in the apprehension. I say the want of discernment, because the plans are essentially different; and I say unfairness, because I believe few persons besides Mr. Hookey and his "Friend" would harbour such an untenable position.

If Mr. H.'s "Friend" had imitated the candour of your correspondent W. Y. on the subject, who says, that "the idea *might* have originally occurred to Mr. Weekes," although he conceives it to have been acted on before (No. 219, p. 251), any further remarks would have been uncalled for from me.

The plan of Mr. Weekes could not be wholly copied from Mr. Hookey's, because they differ materially; and that a part is copied, is only *supposed* by Mr. H.'s "Friend;" for not a single proof is brought forward to support the idea—not even that Mr. W. ever saw Mr. Hookey's rudder, or had an opportunity of seeing it.

The stress of Mr. H.'s "Friend's" argument is placed in the same cylindrical construction of the back of the rudder and stern post being used in each case; which was foreseen and combated, in my first letter, from its having been used previously by Mr. Snodgrass, in the heads of rudders, which Mr. Hookey and his friend purposely (to all appearance, at least) neglect to notice. But it is evident, since we now find from Mr. Bayley, that it was used, previously to Mr. Hookey, by the merchant-ship builders, that such reasoning cannot serve his purpose. The principle, also, is of such common application, that it would be absurd to attach the origin of it to Mr. Hookey; even the pintles and braces of a rudder are constructed on that principle, and every hinge which we see to a door suggests the same idea.

2. The truth, however, of the subject is, that the two plans differ essentially, inasmuch that while that of Mr. Weekes is applied with advantage, that of Mr. Hookey is totally inapplicable to large ships; and till he can show that it may be safely used in vessels of great burden, time is ill spent in discussing the merits of it. With much propriety does Mr. Bayley say, that "the only person benefited by his mode, is the timber merchant, by the greater consumption of timber; and that a much greater risk of breaking the braces is incurred, by the distance which their eyes must project from the stern post."

If Mr. Hookey maintains that Mr. Weekes *must* have copied his rudder (which is a very bad one), he must also infer that the merchant-ship builders imitated it; but this is impossible, because they used the principle in question long before him. The reverse may be the case—namely, that Mr. H. took it from the merchant-ships; but that I shall not, in imitation of him, insist on, as it might have been otherwise. Perhaps he might also have invented his plan for bending timber (for which the Quarterly Review intimated that he obtained his promotion to assistant builder, if I mistake not); though the building of the Peacock shows it to have been used before him, and the plank round the Dutch bows has long been worked in that way.

I regret that Mr. Bayley should have understood my letter in the sense of conveying a stigma on the merchant builders, which was not intended by me. It is not improper, however, to conceive that both may derive advantage by reciprocal communications on their important art, on the excellent and proper performance of which immense wealth, and the lives of numerous human beings, depend.

In the designing of ships, and in variety of experience, the merchant-ship builders have certainly the advantage of the King's ship builders, as the duty of the latter is confined to building from given draughts, and repairing ships of war.

The peculiar benefit of the *fish form* of Mr. Hookey's rudder I do not clearly perceive: the analogy is certainly incorrect; as a rudder is not acted on like the tail of a fish, nor is the flexible motion of a fish's tail like the motion of a rudder; the tapering must diminish the force of the water on it, by causing it to strike more obliquely. Therefore, as nobody has adopted it, we may conclude that it is not of very apparent advantage.

To conclude this letter, I must beg still to give a decided preference to Mr. Weekes's plan of the rudder for intercepting ropes to any I have yet seen; for I have since found there are many, though (as I am informed by shipwrights from Ipswich and other ship-yards in the North) none of them are precisely similar to it. The common plan of a sole, projecting from the keel under the joint of the rudder and stern post, is liable to the accident of its being carried away, or injured, by a vessel taking the ground; nor are any of them so complete and simple as that explained in my first letter of your Number 209.

A Friend to the Mechanics' Magazine.

A NEW METHOD OF LIFE PRESERVING.

Sir,—A sea-faring man observed to me, that ships could not conveniently carry boats large enough to convey the crew and passengers in case of danger; but particularly packets and vessels carrying passengers. I have just thought of a contrivance already available, which will be better understood by the following arithmetical calculation.

Suppose a ship should be sinking, and the crew consisted of twenty-four men, *each* weighing one hundred pounds, and that the ship's boat would *only* carry twelve of the men. Let four of the men be stationed *in the boat* to row it, and let the remaining twenty arrange themselves equally all round the boat (leaving room for the oars to act), up to their necks *in the water*, holding by the boat to save them from sinking. Each man will lose as much weight as is equal to the weight of the quantity of water he displaces. Allowing this to be sixty pounds, the weight of the twenty men resting *on the boat* will be eight hundred pounds; and when added to the weight of the four men *in the boat*, will be twelve hundred pounds, or no more than what twelve men would have weighed if seated in the boat.

Yours, &c.

J. WEBB,

City-road. *Engraver.*

COMPENSATING PIANO-FORTE.

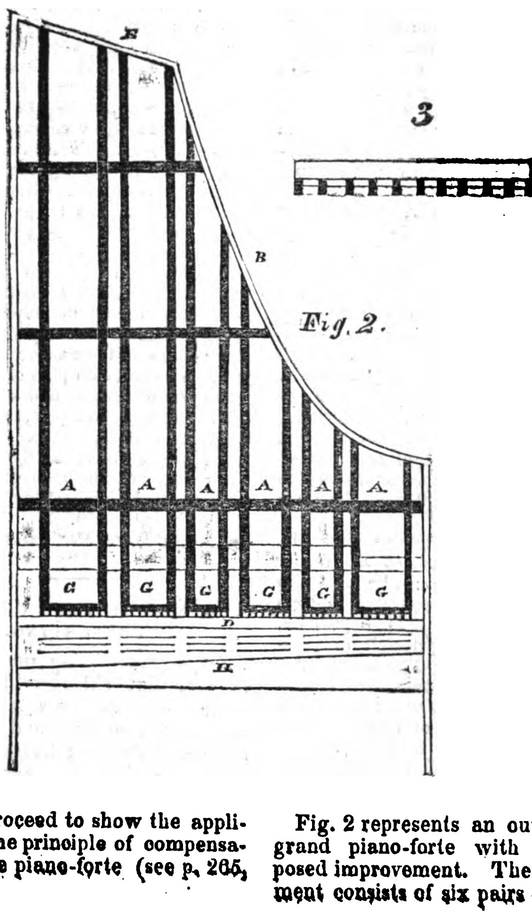


Fig. 2.

I now proceed to show the application of the principle of compensation to the piano-forte (see p. 265, No. 220).

Fig. 2 represents an outline of a grand piano-forte with my proposed improvement. The improvement consists of six pairs of bars or

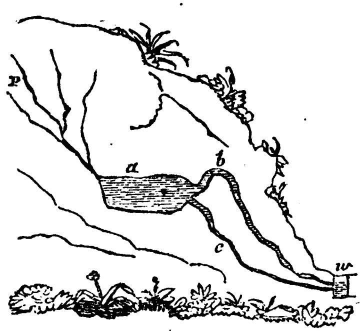
tubes, firmly fixed to the bent side B, and end of the instrument E, having their other extremities connected by strong cross pieces G G, &c.; which cross pieces must all lay in one straight line, as shown in the figure. A strong beam D must be fixed across the instrument, over the wrest plank H; which beam must have a number of projecting pieces, to form as many apartments for the levers as there are notes in the instrument; part of this beam is better shown at fig. 3. This beam must have a strong wire passing through all the projecting pieces, for the levers to turn upon; and must also be so fixed that all the short arms of the levers can be brought into contact with the cross pieces which connect the tubes when the wires are fastened to them. As there are three wires to each note, each lever must have three wires fastened to it, and likewise wound round the three wrest pins. I need not describe its action, as that will be easily understood by reference to my first letter. I have proposed six pairs of tubes, on the supposition that the wire is changed in size that number of times; the tubes must likewise differ in thickness, in order to keep the arms of all the levers equal, as the wire differs in thickness. The tubes must likewise pass through the cross beams I I I, in order to prevent their bending when they expand, as they will have a great resistance to overcome.

Yours, &c.

A Member of the London Mechanics' Institution.

GIGGLESWICK EBBING AND FLOWING WELL.

Sir,—In No. 217, page 216, Athelstan has given a description of Giggleswick well, and states that springs of this kind are under the influence of the wind, and in a great measure subservient to its variations. It appears to me, that the phenomenon for which it is remarkable may be better explained on the principle of the syphon. If the weather is very wet or very dry, the phenomenon ceases. When the former is the case, it may be accounted for by the stream running into the reservoir as fast as the syphon can empty it; when the latter is the case, it may be concluded that there is another small opening as well as the syphon, through which a portion of the water in the reservoir makes its escape; and when the spring is weak, the whole is discharged through this second aperture. The following figure will more fully illustrate my meaning.



P is the passage by which the water enters the reservoir *a*, which filling before the syphon *b* begins to run, the greater part of the water escapes through the smaller aperture *c*, especially in dry weather. *w* is the well at ebb, which, as soon as the syphon commences running, will begin to flow; and when the syphon is stopped, will again ebb.

I am, Sir,
Yours, &c.
THE NORTH STAR.

Lancaster, Oct. 25, 1827.

ROOFING OF THE NEW PALACE, ST. JAMES'S PARK.

Sir,—Seeing in your Mechanics' Magazine for July (No. 205), that the roof of the Picture Gallery in the new Palace is covered with slate, embedded in a composition of hot tar, lime, and sand, and that the roofing of the other parts consists of a similar composition, may

I request, through the medium of your Magazine, to be informed of the proportions of such composition, and when and in what manner it is applied.

I am, Sir,
One of your First Subscribers.

MR. JOPLING'S SEPTENARY SYSTEM.

Sir,—I have now before me No. 220 of your Magazine; in which, in page 262, Mr. Jopling says, "In a former number of your work I had occasion to notice the *improper use* Mr. Alderson made of information I gave to him." The said *former Number* is 211, where, on page 118, may be seen what he had occasion to notice. Now, in justice to my friend, as I was present when he showed him the instrument, permit me to observe that, as to what passed between them, neither enjoined the other to secresy; therefore I consider there can be no breach of confidence, nor do I remember that he (Mr. J.) gave him *any information* that was of service to him, Mr. Alderson's instrument being then as *perfect* as it was when it was sent to the Society of Arts.

Were I situated as Mr. J. is, as to invention, I should give the public an account of it as early as possible, as the only sure way of securing to myself the credit due to my invention: for how could I blame any one (Mr. Desvignes for example), who understands a thing to be possible to *be* done, for *doing* it? It should be remembered that the first in the field obtains the laurel; and that this is the spur to genius. Your insertion of the above will oblige,

Sir,
Your obedient Servant,
J. SEERS.

Chelsea, Nov. 19, 1827.

We deem it but an act of justice to state at once, in reply to Mr. Seers, that Mr. Jopling *has* already given full publicity to the principles of his system, though he has not certainly specifically described the various instruments by which these principles may be carried into operation. His pamphlet on the subject was published as far back as 1823; and long ere now its contents would have been brought under the particular notice of our readers, but for the protracted indisposition of an ingenious friend, who had requested that we would leave to him the task of developing and enforcing the novel and important truths which Mr. Jopling has brought to light. In the expectation that we may yet be favoured with our friend's essay, we shall at present merely attempt to put our readers in possession of a brief abstract of what Mr. Jopling has made known to the world.

Few are ignorant that the artists of antiquity, especially those of Greece, and of the craft of Freemasonry, possessed a degree of skill in the generating of curves of all descriptions, far superior to any thing which the moderns have hitherto been able to attain. It has been with good reason inferred, that they were in possession of principles which have been lost to their successors; principles which enabled them to produce, by continued motion, *perfect* curves of every variety; instead of having recourse, like the artists of a later day, to all sorts of approximating expedients—such as ordinates, intersections of right lines, sweeps of different circles, &c. It is not thirty years since Mr. Peter Nicholson first (among the moderns) discovered how to produce an oval by continued motion: but this is but one of a great many figures, over which the ancients appear to have had a complete mastery.

Mr. Jopling lays claim to having at length traced out the entire system of principles, to a knowledge of which the ancients were indebted for their great superiority in all the arts of design. It is, at least, as Mr. J. remarks, a curious fact, that the same fine forms which they have given to vases, spirals of all kinds, mouldings, every description of Gothic curves or arches, &c., may, by means of his septenary scale, be generated *in a perfect manner.*

During the year 1822, several new

methods of generating varying curves by the *continued* motion of a point were invented by Mr. J.; and, pursuing his investigations, he not only ascertained in what way these methods were connected with the other modes of generating curves by continued motion, previously known, but found that the production of flowing figures of all kinds might be resolved into a septenary scale or system.

Each of the seven divisions of the scale is formed by different modes of regulating the motion of one plane in contact with another plane at rest, by *poles, right lines*, or *circular lines*. Mr. J. states that, by these different modes, "curves of an *infinite variety* may be generated by continued motion, either for the *most delicate engraving*, or for works of the *greatest magnitude*."

Examples of this—as far, at least, as regards the third division of the scale—have been supplied by Mr. Jopling, in the different papers which he has done the Mechanics' Magazine the honour of making public through its medium. (See Nos. 206, 211, and 220.)

A *complete illustration* of all the divisions of the scale has *not* yet been published; but for reasons which, we doubt not, will be considered abundantly satisfactory.

Such an illustration must be *a work of time and great labour*. Mr. J. calculates that it will require some thousands of examples to illustrate all the divisions of the scale. When complete, the work would be one of reference, similar to a book of decimals or logarithms, by consulting which a person might be able at once to generate correctly any form of any size: *a work of great expense too;* greater than any individual can be reasonably expected to incur for the common good, on any speculation of future indemnity. "To describe examples in the most accurate way, instruments must be made mathematically correct; they must also be properly graduated, and must have the necessary movements and adjustments according to the variety of curve desired."

But although Mr. Jopling at once stated that "he could not at present conveniently afford the time and attention (to say nothing of the expense) required to bring forward such a work," he very handsomely added, that "if arrangements could be made with any gentleman who might feel an interest, and have leisure to engage, in the illustrations of the principle, *the author would with pleasure communicate to him the plan that he has adopted.*"

It would seem that no person has yet availed himself of this liberal offer; but that, on the contrary, more than one individual, instead of consulting Mr. J. as to the means by which the principles of his system may be reduced to practice, have thought it more convenient to borrow a principle or two without acknowledgment, and to try to find out the practice for themselves. We agree with Mr. Seers, that "the first in the field (usually) obtains the laurel, and that this is the spur to genius." But who does he consider first in the field?—the individual who points out the way, or him who follows it?

The fact is, that a work of this kind ought not to be left to *individuals:* it is one of national concern, and ought to be undertaken at the expense of the nation. Mr. Babbage obtained, on the recommendation of a Committee of the Royal Society, a grant of 2000*l*. (we believe) to complete his machine for Arithmetical Computations; and, for every reason which could be urged for that grant, we think we could find a dozen in favour of a similar act of liberality to Mr. Jopling. We shall return to the subject.

Ed. Mech. Mag.

[Since the above was in type, we have received a letter from Mr. Alderson himself. It shall appear in our next.]

RAT TRAPS.

"How now! a rat?
Dead for a ducat, dead."

Sir,—Many have been the plans proposed for the destruction of those

destructive vermin, rats. My attention has been called to the subject by the insertion in your Magazine of a plan for a new trap; and I am of opinion, that the more devices there are offered for the entrapping of this cunning pest to our houses, warehouses, &c. the better; for their caution is so great, and their fears so quickly excited, that it is difficult to circumvent them at all; and when a trap has been once or twice used, they fight very shy indeed of it, and I have remarked that it is generally the young rats, and not the old ones, who are caught. The following plan is one which has been practised with considerable success in large places where rats abound. Pierce a large cask or butt, which half fill with water; then cover it tightly over the top with parchment; place it in the barn, warehouse, or other place where this animal mostly comes, and set two or three boards for them to ascend to the top: for several nights strew the planks with oatmeal, to entice them to some banquet at the top; this will draw many rats to the spot. When this process has been followed a short time, slit several openings in the parchment, so that a rat may fall through; the prey will come as usual unsuspicious of danger, when one or more will fall through; when they find themselves in danger, they will raise piteous cries, and their brethren, hastening from all parts, rush up the plank and indiscreetly fall into the snare prepared for them. This plan has the merit of destroying many at once, and may at intervals be practised very successfully.

Snaring the rats at their holes with copper wire is a very good plan, as they cannot easily, by any of their cunning, avoid the snare. I have caught one at every hole, in a single night, at which I placed a snare. The rat is so extremely suspicious, so nice in its scent, and cautious in its movements, that the same trap will hardly serve twice; the best way is to change them as often as you can, and to vary your mode of attack as frequently as possible. But, after all, the most effectual method to keep off this formidable animal, is to keep a good Tom cat, who will fearlessly combat them: the smell of a cat is almost sufficient to drive them away; but a good one for catching them is far better than any trap, although the latter is often used as an auxiliary to the former.

I hope I have not trespassed too much on your pages, in treating of the best mode of catching these destructive little creatures; they commit depredations, the extent of which would astonish any one who never before had witnessed their operations. The stoutest beams are not proof against their sharp teeth: they will so undermine a building sometimes, especially old ones, where the chief support is wood, as to endanger the very foundations.

I am, Sir,
Your obedient Servant,
O. G. L.

A PLAN FOR CLEARING MOSS FROM FRUITT-REES.

Sir,—I beg to recommend the following method of clearing moss from fruit-trees to the notice of the readers of the Mechanics' Magazine.

Sprinkle or dust the mossy limbs, when their leaves are off them, in damp foggy weather, with common wood-ashes; and in two or three months the moss will disappear, wherever the wood-ashes have touched.

I am, with respect,
Yours obediently,
JAMES COX.

Nursery Place, Hackney,
Sept. 6, 1827.

INCREASE OF HUMAN FOOD.

(*Vide* Nos. 209, 213.)

Sir,—I have read with great interest your Extract from the "Caledonian Mercury," in No. 209; and Mr. Goulson's commentary thereon, in No. 213, would have afforded me equal pleasure, but for his assertion that "the conversion of potatoes

into flour is a process *quite out of the reach of human ingenuity.*" Now, Sir, your first paper had no sooner fallen into my hands, than I set about exerting whatever share of ingenuity is allotted me, to effect this very conversion; but disappointment met me at every turn—of my "barrel." I should, however, have persevered, but for Mr. Goulson's discouraging statement, and for various failures which I encountered in my inquiries among *bakers, who, one and all, disclaimed all knowledge of potato flour.* And now, before I relinquish the experiment, I would solicit from some of your intelligent correspondents a description of the process, *ab initio*, for obtaining potato flour."

Many of your numerous readers will, doubtless; be thankful for the information; and its possession would enable me to extend more valuable relief to my poor neighbours, than I am now able to do, with my winter store of potatoes in their natural state.

The subject is certainly one of almost vital interest to our increasing pauper population, and recommends itself equally to the economist and to the philanthropist.

I remain yours,

X. X.

Brentwood, Nov. 10, 1827.

FELIX FORD.

The mathematical readers of our Miscellany will learn with regret that our esteemed correspondent, Felix Ford, is no more. The name, it may not now be improper to state, was an assumed one; but were we at liberty to mention who Felix Ford really was, the learned world would recognize in him one of the ablest mathematicians and most worthy men of the age. During an interval of his last sickness, when his friends indulged sanguine hopes of his recovery, he amused himself with the following solution; but, while in the midst of it, experienced a relapse, which terminated his valuable existence:—

$$\left.\begin{array}{l} x^2y+xy^2=a \\ x^2+y^2=b \end{array}\right\}$$ To be solved by a quadratic equation.

We invite some of our correspondents to favour us with that solution, which the hand of death prevented their lamented brother contributor from completing.

ON LIGHTNING CONDUCTORS.

Sir,—At last Lieut. Green has come forward with his reply to the statement of Mr. Harris. I had almost feared that he had relinquished the point, and, by silence at least, yielded consent to his opponent. I am glad to see that he has not: discussion alone can elicit the truth; and to come at the truth is our common object. I have no personal or angry feelings towards Lieut. Green, neither have I any knowledge of Mr. Harris; I may, at any rate, then, claim to be freed from the reproach of any personal or party feeling. Being entirely ignorant of what has before passed between Lieut. G. and Mr. Harris, I cannot of course notice the remarks of the former gentleman, connected with their previous discussion of the subject in some country paper. I shall only take a few facts, as I find them in his last letter, and comment briefly on them.

Lieut. Green states, that he merely mentioned the instance of Professor Richman, to prove that rods *are* attractors; and he asserts boldly, that "if the Professor had not placed one to his house, the accident *could* not have occurred:" that it might not, nay, even that it most probably *would* not, I admit; but when he says "it *could* not," I ask—Why? Surely it is not necessary to bring forward proofs that rods *are* attractors; the fact is admitted by all parties. The question is merely whether the attractive influence increases the danger which it is intended to avert. But as Lieut G. is thus anxious to prove the fact, that rods *are* attractors, let me ask why we are not, instead of an instance in a century, constantly hearing of dreadful explosions and accidents resulting from the use of rods, so common in large mansions and

other buildings? They serve to *attract* the electric fluid from the clouds, according to his own statement.—Why are they not oftener attended with fatal accidents, if their use is attended with such vast danger? Facts speak for themselves;—they do *attract* the fluid, but they convey it silently and in safety to the earth; this being a silent operation, and not subject to notice, is therefore supposed not to exist: when, however, from some bad construction or arrangement of the conductors, any accident happens, it is immediately seized upon as a decisive *proof* of the inefficacy and danger of conductors!—Is such reasoning just?

In mentioning the accident which occurred to Heckingham poor-house, Lieut. G. says, "Does he mean to say, although the lightning is attracted to the point of the conductor, unless it terminates in water, that the superabundant fluid will, as if by instinct, reascend and fire the house? If lightning is once conveyed to a rod, it will readily find its way to the earth, which, whether wet or dry, by means of its open pores, will disperse it." This latter sentence is a clear admission of the utility of conductors. He before asserts, that the lightning is attracted, or conveyed, to the points of a rod; he now admits that, if this is the case, it will "*readily*" find its way to the earth. This is all I require to establish my argument, and this he grants. From what I recollect of Mr. Harris's statement, I think he makes no assertion of any *positive* danger to be apprehended from the end of the rod being placed in a dry soil; but as water is a conductor, it follows of course that the electric fluid would be dispersed much more readily in a *moist* than in a dry soil; and I need hardly add, that the more readily the fluid is dissipated, on reaching the ground, the greater is the certainty of safety.

With regard to the "Milford," I see no reason which justifies Lieut. Green's inference, that the conductors of the other ships attracted the lightning to this one. The ships were, no doubt, at some distance (however small) from one another: and from their very nature, any number of rods would draw down the lightning silently, and each to their separate points, and rather draw it off, than draw it upon, the neighbouring objects. We may, however, fairly conclude that a conductor, in this case, would have *saved* the Milford.

I have no desire, in order to prove my assertion, that any one should actually sit upon a barrel of gunpowder while a shock was passed through it; yet, judging from the experiment on a small scale, I have no hesitation in declaring, that he might do it in safety, provided the wire, or conductor, passing through the barrel, were in one piece only. Lieut. G. quotes the authority of Professor Leslie, who states, that "conductors are *attractors* and *accumulators*, and not *protectors*, and are merely sufficient to control the superabundant electric fluid which may come in contact with them;" which I suppose means the atmospheric electricity. He says "*attractors*"—I admit it; he further says "*accumulators*," not protectors; but an *accumulation* can only take place where the conductor is *insulated*: the application of the term, therefore, is erroneous; and Lieut. G., in fact, has himself before declared it to be so, by saying that the passage of the fluid to the earth through the conductor is *readily* effected; and Prof. Leslie's name even will not support a false argument.

One word more, Sir, and I have done. Lieut G. *asserts* that the conductors *do attract* the lightning. He admits that the passage through them is direct; and, lastly, he says, in speaking of Mr. Corydon's conductors, "the fluid is perceptible when darting into the sea." Is any comment upon this needful? Does it not establish, by his own words, the utility of conductors?

AMICUS.

Nov. 20, 1827.

ON THE FIGURES IMPRESSED ON THE FROZEN SURFACES OF LAKES, RIVERS, &c.

Having been a subscriber to your valuable work from its commencements, I take this opportunity of presenting to you my acknowledgments for the very liberal and impartial manner in which it is conducted; and as its columns are open at all times even to the most humble inquirer, perhaps you will allow me, through the medium of its interesting pages, to lay before your philosophical readers some particular phenomena which I am totally unable to account for, and some parts of which, in my opinion, explode a doctrine which was some time ago generally adopted by men of considerable talent, on a subject something similar, and which I hope will now be reconsidered, and more satisfactorily explained. A friend of mine, Mr. George Chapman, brass and iron founder, of Whitby, had occasion, in the depth of winter; to sink a well on his premises for the purpose of supplying a small steam engine with water. The diameter of the well was seven feet, and he had sunk down about twenty-one feet: the stratum at that depth was an uncommon soft clay, and the water which oozed from the side of the well being considerable, the man at the bottom could not stand without sinking half leg deep in the clay and water, which was insupportable at that inclement season of the year. To render his situation more comfortable, my friend put down half a treacle hogshead for him to stand in, and, by shifting it about as he wanted, he then managed to go on with the work. The upper part of the well having shown symptoms of falling in, some planks were placed vertically against the sides, and two iron bars were placed across the well to protect them, and keep them in their places, leaving sufficient room between them for the bucket, &c., going up and down the shaft. At this time it came on a very stormy day, with heavy rain, so that the workmen were obliged to desist: the half of the treacle cask was left at the bottom of the well; the bucket was left in the *inside* of the half cask, and also an article we call a piggin, which is a small tub, with one of its staves about six inches longer than the rest for a handle, and which are commonly used here for baling boats and other such purposes; this was also with the bucket in the *inside* of the half cask, and had accidentally been placed against the side of the cask in a sloping position. The rain fell in torrents the whole day, and nearly filled the well with water; during the night it came on a severe frost, so that the water in the well was completely frozen over, and the very singular phenomena I am about to describe were distinctly observed the next morning. Across the ice, parallel with, and exactly perpendicular, over the two bars of iron, were not only distinct lines in the ice corresponding with the size of the bars, and clearly pointing out their exact situation, but also a circular mark of the half treacle hogshead at the bottom; and it was so distinct, that you could clearly observe the indenting of the bung-hole where it had been sawn across. What to me is still more extraordinary, the mark of the bucket in the inside of the half cask, and also of the piggin, was equally observable; and even the sloping position that the piggin was placed in against the side of the half cask, distinctly discoverable in the ice. I recollect some years ago a circumstance something similar being noticed.—The Serpentine River, in Hyde Park, being frozen over, the traces of a human body were distinctly marked in the ice; which on being broke, the body of a man was taken from the bottom: various opinions were given on the causes of this singular phenomenon; and the one most generally adopted, was inserted in Nicholson's Journal. It was, if I am not mistaken, that there is continually a quantity of hydrogen gas escaping from the bottom of rivers and stagnant waters; and that the body of this man preventing the bubbles of hydrogen

arising from the place whereon it was laid, caused the appearance in the ice above. As the same operation of nature might be going on at the bottom of this well, I should have rested satisfied with the same solution, if there had been nothing in the well but the half of the treacle cask and the iron bars above, or if there had been only the marks of those articles in the ice; but I am quite at a loss to reconcile with this cause alone the distinct appearance of the bucket and piggin, which were placed in the *inside* of the cask as before stated. In fact, as I have said before, I think these appearances explode the above theory altogether; and I trust that some of your philosophical contributors will endeavour to account for these extraordinary phenomena on more satisfactory principles.

I am, Sir,
Your very obedient Servant,
JOHN HUGILL.

Whitby, Nov. 1827.

PENMANSHIP.

Sir,—I shall be obliged by your inserting the following in your useful work.

I have long been looking in vain for a set of copy slips fit to place before a child, and have met with many of the large or round hand, or text and half text; but have hitherto failed in the small or running hand. Some time back, I saw advertised "The Edinburgh Penman," being a set of copy slips by W. H. Lizars, in the following terms:—"The publisher, in offering this improved set of copy slips, has endeavoured, by a few examples, to illustrate plain and ornamental writing, and business forms, which are practically useful; thereby obviating to the teacher the trouble of instructing from a multiplicity of slips of the same character; and to the scholar, the perplexity of having before him a lengthened set of laboured specimens, which only consume time when at school, and are thrown aside on entering the pursuits of life."

Thinking I should obtain what I wanted, I sent for a set; but how great was my disappointment! The text and half text were very well for heading ledgers; but the small or running hand was of no use whatever. Instead of being a quick running hand, suited to the business of life, it was a stiff, set, formal hand; the down strokes much too thick, the smaller letters at least one-fifth too large, and the capital letters out of all proportion, being nearly five times as large as the small; three and a half is a good proportion.

I should be glad if some engraver would publish a set of small or running hand copies—a free, slanting, easy, running hand, with very little difference between up or down strokes, fit for letter writing; I am confident, if made known, there would be a great sale for them.

Yours respectfully,
A. O.

Nanty, Gloucester,
Oct. 1827.

NOTICES TO CORRESPONDENTS.

S. G. will find the information he requests respecting the mode of preparing tracing paper, in vol. i. p. 365.

We beg to refer R. D. E. to our engraver, Mr. Walker, 10, Guilford-place, Spa-fields.

"A Subscriber's" corrections in regard to the parties employed in the erection of Hammersmith Bridge, are unavoidably deferred till our next.

S. Y. may obtain what he wants of H. and C.

M. T. has adopted very characteristic initials.

Communications received from F.—Mr. Baddeley—F. D.—G. G.—J.—Mr. Hingston—Mr. Davy—F. E. Q.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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Mechanics' Magazine,

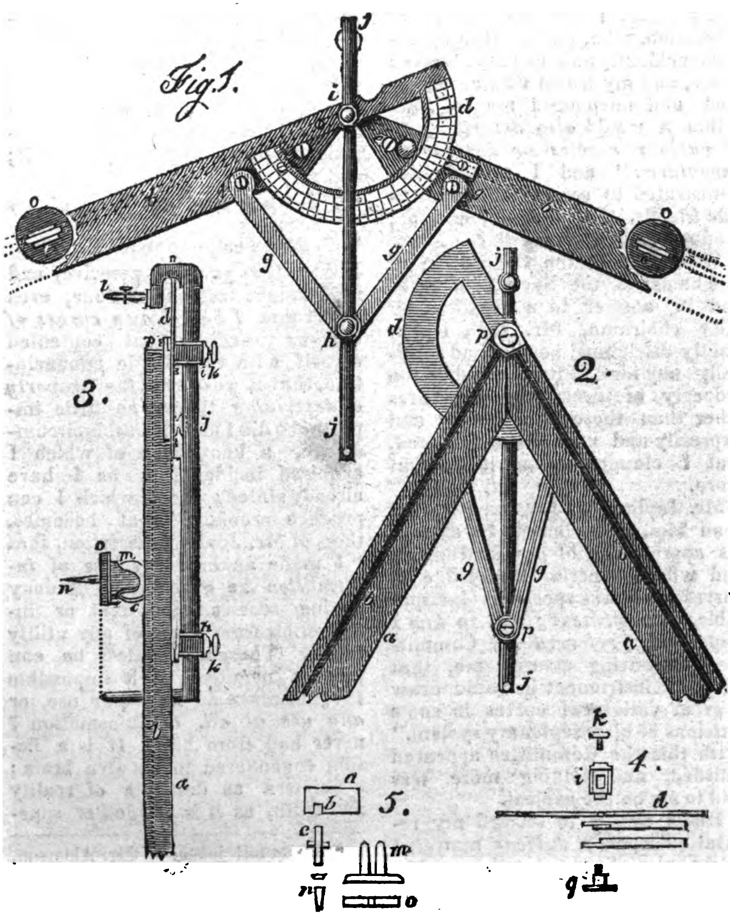
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 224.] SATURDAY, DECEMBER 8, 1827. [Price 3d.

'Tis Liberty alone that gives the flower
Of fleeting life its lustre and perfume ;
And we are weeds without it. All constraint,
Except what Wisdom lays on evil man,
Is evil ; hurts the faculties, impedes
Their progress in the road of Science ; blinds
The eyesight of Discovery ; and begets,
In those that suffer it, a sordid mind,
Bestial, a meagre intellect, unfit
To be the tenant of Man's noble form.

Cowper.

MR. ALDERSON'S CURVILINEAD.



MR. ALDERSON'S CURVILINEAD.

Sir,—Adverting to Mr. Jopling's communication respecting his "Septenary System," published in the Mechanics' Magazine, 8th Sept. and 10th Nov. 1827; where, in two notes, "all neither wholly false, nor wholly true," he attempts to fasten a charge against me of a deviation from *propriety* in my report to the Society of Arts, on the properties of the Curvilinead, a mathematical instrument invented by me for delineating segments of circles; I have, in justice to myself, to state, that previous to submitting it to the Society, or showing it to Mr. Jopling, I took it to Mr. Peter Nicholson, who, putting it in operation, incidently and casually observed to me, and my friend who accompanied and introduced me to him, "that it would also *describe arcs of various species or degrees of curvature:*" and I actually demonstrated to several of my scientific friends, that I could, and did, produce *such* curves with it.

When before the Committee of Mechanics of the Society of Arts, and in answer to a question by their chairman, Mr. Gill, I distinctly disclaimed having had originally any idea of its possessing the property of describing any arcs other than those of a circle; and expressly and unequivocally stated, that I claimed no merit on that score.

Mr. Jopling, who, when I waited upon him, was pleased to express his approbation of my instrument, and whose superior knowledge of curves of various species is indisputable, was *present;* and to *him* I respectfully *referred the* Committee; he having assured me, that with my instrument he could draw a great variety of curves in some divisions of his "septenary system." With this the Committee appeared satisfied, and nothing more was said to *me* on the subject.

Had I chosen to hazard my reputation upon a *dubious* matter, I might also have stated, as Mr. Jopling did to me, that he could draw the Grecian volutes with it. But I left that for him to do; my ambition being quite satisfied that I had been fortunate enough to invent and produce the best and most useful instrument, for the purpose of drawing segments of circles of any diameter, and in any required position.

In order that you may have a correct idea of what I wrote to the Society of Arts on this subject, I have subjoined a copy of the paragraph which relates to this particular point.*

I am at a loss, Sir, to discover wherein any candid, ingenuous person—any one other than those who place their felicity in *conjuring* up *shadows*, that they may enjoy the superlative happiness of wrestling with, and heroically combatting them—can justly impute blame, or attach culpability, to a statement as clear, perspicuous, and unostentatious, as I could possibly make it; and yet,

> "The whole head and front of my offending
> Hath this extent,—no more!"

I did not, as you will perceive, and as I might truly have done, even assert that *I had drawn curves of various species;* but contented myself with the simple annunciation, that it *possessed* the *property* of *describing* them: so little importance did I attach to this circumstance, a knowledge of which I acquired incidentally, as I have already stated; and of which I can produce proofs. What becomes, then, of Mr. Jopling's assertion, that "I made an improper use of *information* he gave me?" I deny having received any hint or information from him, of any utility to me. Therefore, unless he can prove a negative, it is impossible I could make an *improper* use, or *any use at all*, of information I never had from him. It is a fiction engendered in his own brain; a chimera as destitute of reality and truth, as it is altogether supe-

* To do full justice to Mr. Alderson, we have thought it better to subjoin the whole of his communication to the Society of Arts.—EDIT.

rogatory and uncalled for. There are unhappy people, who have an unaccountable propensity to "fish in troubled waters:" but I have no such ambition; I envy not, nor impede, any man in his *laudable* endeavours to reach the Temple of Fame.

"But few, alas! the casual blessing boast,
So hard to gain, so easy to be lost."

That Mr. Jopling can draw the Grecian volutes with my instrument, in a continuous line, and of any assigned dimensions, is a fact yet *doubted* by many of my friends. But, if he can, nobody will hail the circumstance with more delightful emotion than myself. In the *uninterrupted continuity* of the *line*, I imagine, will the merit and utility of any mode of drawing volutes *mechanically*, essentially consist.

I can draw a volute with my instrument, by previously dividing the assigned dimensions into quadrants, or portions, in the way usually done when delineated with the compasses. But the trouble of removing the centres is great, and the extreme nicety and precision required to connect the points or lines, without crippling them, will ever deter me from using it for that purpose. My aim and object was, to invent an instrument wherewith to delineate segments or portions of circles only. And if the recorded opinions, and unqualified approbation of such eminent mathematicians, engineers, architects, and draftsmen, as Mr. Peter Nicholson, Mr. Brunel, Mr. Murray, Messrs. Maudslay and Field, Mr. Taylor, &c. &c. &c., as well as the Society of Arts, may be taken as a *criterion*, I have been *successful;* and I humbly presume to hope that, in the estimation of every candid man, it is no disparagement to me, if I have not exactly adapted my instrument for an operation, and to effect a purpose, I never contemplated!

Knowing the full value of a character void of reproach, I trust that *you* will see no *impropriety* in my humble endeavour to vindicate *my own;* and, finally, deeming this an ample apology for the trouble I have reluctantly occasioned, you will, by inserting it, at your earliest convenience, oblige,

Sir, yours, &c.
JAMES ALDERSON.
4, *Bridge-row, Pimlico,*
November, 1827.

Letter from Mr. Alderson to Arthur Aikin, Esq., Secretary of the Society of Arts.

Sir,—Herewith I beg leave to submit, for the approbation of the Society of Arts, &c., a mathematical instrument of my invention, called a Curvilinead; wherewith to describe regular curved lines, or portions of circles, of any diameter, with ease, accuracy, and despatch.

In my professional avocations, as a mechanical and architectural draftsman, I have frequently had occasion to lament the want of such an instrument as this; which is, I trust, perfectly adapted to all the purposes of a drawing board, that practical draftsmen can require for truly delineating segments of circles.

The arms of the instrument *a a* (see figs. 1, 2, 3) are formed of two pieces of well-seasoned mahogany, two feet two inches long, one inch broad, and three quarters of an inch thick; but they may be made to any dimensions, as convenience or necessity may dictate. These arms are connected at one end, by a brass joint, one eighth of an inch thick, let into the wood flush with their upper surface. The grooves *b b*, in the under surface of the arms, if continued, will intersect each other at the angle, and coincide in the centre of the joint; which, by the curved form given to the end of the sliding bar *j j*, fig. 3, is also the point of the pen or pencil *l*. By these means, the segment of a circle of any dimensions may be accurately delineated from three given points: namely, the extremities of the chord line of the arc to be described, and the sagitta or rise of the arch; or, indeed, through any three given points within the compass of the instrument.

The index mark *f*, fig. 1, is fixed exactly over the middle of the groove *b b*, in the under side of the leg, and, by means of the graduated semicirle *d d*, shows the angular distance of the two grooves. The instrument cannot be set to a less angle than 60°, (see fig. 2); nor is it necessary, as it will at that angle describe an arc equal to three quarters of a circle. The steel screw *p*, figs. 2 and 3, connects the brass joint at the angle, and also perforates and

fixes perpendicular thereto the swivel-box *i*, wherein the bar *j j* slides. When this screw is taken out, the two legs may be brought parallel to each other, and in this state the instrument is rendered very conveniently portable. The other swivel-box *h*, through which the bar *j j* also slides, forms the joint of the two arms *g g*, by a similar screw *p*, which are thus enabled to adapt themselves to whatever angle the instrument may be opened to at the same time: by means of their bearings *q q*, on the legs *a a*, they keep the bar perfectly steady.

In order to prepare the instrument for use, the legs are to be extended to the required angle, and are secured in that position by tightening the binding screw *e*, as well as the screws *g g*; the sliding bar *j j* is then to be adjusted, that the joints of the pen or pencil *l*, fig. 3, shall coincide with the prolonged axis of the screw *p*, and it is to be secured in this position by the binding screws *k k* of the swivel-boxes *i h*. When the angle is to be changed, all those screws must be previously loosened; a precaution which must be carefully attended to, lest the instrument should be strained or broken.

At the rear end of the sliding bar is a verticle hole for the reception of a round pointed peg *r*, fig. 3, of wood, ivory, or metal, just long enough to touch the paper on which the arc is to be described. It serves to preserve the horizontal position of the bar, and affords much facility in working the instrument.

o o, fig, 1, are two plates or carriages that support the swivel roller *c c*, which take into the grooves *b b*, and on which the instrument traverses. The various parts of the roller, with its carriage, are shown combined in fig. 3, and separate in action in fig. 5; *a* one of the legs, *b* the groove, *c* the roller, *m* the cheeks between which it hangs, *o* the plate, *n* a point projecting from the under side of the plate, in order to fix it in the drawing-board.

Fig. 4 shows, separate, the parts which unite at the joint or angle of the instrument.

Parallel arcs being sometimes required, these may readily be drawn by this instrument, by first describing the interior arc, and then sliding the bar *j*, and consequently the pen or pencil that it carries, so far beyond the angle of the instrument as corresponds with the required distance between the two arcs, and then describing the exterior one. Such arcs, it is true, are not strictly parallel, because the centre of the exterior curve advances a little beyond that of the interior one; but, where only small arcs are wanted, the error, practically speaking, is imperceptible. If large arcs with considerable distances between them are required, other methods must be had recourse to.

The semicircle, or protractor, is divided into one hundred and eighty different parts, each of which is to be considered as *two* degrees. Therefore, in estimating the quantity contained in an arc described, care must be taken to reckon from *zero* on the *outer* graduation towards the index. Thus, if the index stands at 50, 60, or 70 degs., the arcs described contain respectively 100, 120, and 140 degs.

To obviate the apparent necessity of placing the centre pins at the extremities of the required arc, I would refer the practical draftsman to the two very useful problems in Mr. Peter Nicholson's Builders' Directory; namely, problem 58, page 58, and problem 37, page 39; whereby it is demonstrated that the points may be placed at the two extremities of the paper, and the same arc will be produced. The same problems also demonstrate that the segment of a circle required may be described and continued to any extent by this instrument, without increasing the length of the arms; all that is necessary being merely to find different points through which the arc required is to pass.

Finally, I have to state that the instrument possesses the property of describing spiral and irregular curve lines, both curious and useful, by varying and altering the position of the pen or pencil from the centre. This property I did not contemplate in the first instance, and it is probable there may be many others of which I am not aware.

I remain, Sir, &c.
JAMES ALDERSON.

[We have yet two more important communications on the subject of Mr. Jopling's system to lay before our readers —one from Mr. Child, of Halifax, and another from Mr. Desvignes. We mention this, that Mr. J. may defer any reply he has to offer, till he can take notice of the whole at once, and that our readers may see the propriety of waiting till they hear all parties, before they form any judgment on the points at issue. Mr. Child's paper we shall give in our next, and Mr. Desvignes's in the following Number.—EDIT.]

ON THE VARIOUS RECENT PLANS FOR IMPROVING THE STEAM-ENGINE.

Sir,—A vast deal has been said and written, during the last four or five years, of the wonderful improvements that have been made in the steam-engine. Though some of the great projectors have been lauded to the skies for their "brilliant discoveries," for their "transcendant talents," as some of your cotemporaries have it, and for a thousand other excellencies; yet, Sir, after all, we have not been shown the astounding effects that were to have resulted from these newly-discovered wonder-working machines. We have not been whirled over the earth, or through the air, in despite of contrary winds or roads of mud; nor have our steam-vessels been relieved of their burthensome Bolton and Watts, but are still left to plough the trackless deep with their labouring load, to the great destruction of fuel, and to the premature destruction of themselves, with little profit to their proprietors. How is all this? I begin to fear that some of our projectors may, like the notable inventor and his cork boots you recently gave an account of, have overlooked some important point—not the centre of gravity, probably, which caused his sudden immersion, to the great amusement of the spectators, but something else equally as essential, that opposes their success. I am, however, far from believing that nothing has been done by some of the individuals towards effecting this important object; and am pretty well convinced, if the candour and judgment displayed in some of the papers that have been written on the subject afford any criterion, that all that can be reasonably expected will at no distant period be accomplished; for I do consider, that some of them do real honour to the ingenuity and ability of the individuals who wrote them.

In some of the projects may be observed something like a principle followed, and due consideration given to the laws that govern the elements that are brought into action; while others appear to build their speculations upon hope and fancy, rather than investigation and knowledge, and are guided in their arrangements by chance, rather than calculation and mechanical skill; so that the number of abortions need afford no surprise.

Not having the honour to be an engineer—being nothing, in truth, but one of the "common" grains of animated dust sticking to the surface of this great inhabited whirligig—I should, in common with many of your less enlightened readers, be much obliged to some of your able correspondents, if they would point out the merits of the several plans that have from time to time been submitted to the public: it would, I am sure, be beneficial both to the public and the parties more immediately concerned; as it would direct support to those of merit, and save the money of the visionary, by exposing his fallacious views.

The friends of Dr. Alban, I understand, say, that could he prevent the escape of the lead through his iron cases, his plan of making steam would be the finest in the world! Now, I am such a dunderhead, that I really cannot understand this; for the employment of a leaden medium seems to me a very heavy absurdity. Apropos—Mr. Gilman says, in his ingenious paper on Heat and Steam, which you gave us a few numbers back, that "the thickness of metal is an object not unworthy consideration," &c. &c. I advise the perusal of the whole of the sentence, as it suits my views to a tittle, and seems every way much to the point.

There is Mr. Perkins, too: he appears to have turned his back upon himself, as Lord Castlereagh would say; and, instead of leading the way, to have given up his original plan, *after all*, as untenable, and to be following in the wake of others. I observed a short description of his last patent in the "Repertory of Arts" for the 1st of this month, where the worthy editor, in his remarks, gives him lots of credit for his ingenuity; but the wicked rogue

insinuates that a great deal of the patent is not new; and simple I would ask whether Mr. P.'s method of condensing is not the same in principle, and not a whit more effectual, than the one of Pattison's, with which we were favoured in a Number of your Magazine, some time ago? besides which, there are several similar plans.

It strikes me very forcibly, too, that the plan of arranging tubes in tiers, as described in this patent, has been patented before, likewise, some three or four years ago; but I cannot call to mind the name of the inventor.

Now, all these things it would be well rightly to understand; and therefore I do much wish that some of your able correspondents will give us their views of these matters: the necessity for it is great, as it would have a tendency to do away much of the puffing and quackery that now exists; and there is every reason to expect, that were any part reviewed erroneously, the projector would condescend to set the matter right—truth being the only object sought; for there seems such a conglomeration or amalgamation (take which you please) and confusion of objects, that any individual, unacquainted with engineering, appears to me to be as incapable of choosing an engine likely to suit his purpose, as he would be of calling the machine itself into existence.

I am, Sir,
Yours respectfully,
A NOVICE.
Newington, Nov. 5, 1827.

RISE AND FALL OF SPRINGS

Sir,—The insertion in your pages of the following journal, for the last twelve months, of the rise and fall of springs in this town, may, perhaps, be the means of inducing some of your scientific readers to make some observations on the cause of the rise and fall of springs. The tides are known to be ruled by the moon, but we are not at present informed what rules the rise and fall of springs in so regular a manner, as will be seen by this journal to prevail. It was made from observations on a well about seven yards deep; and I had an opportunity, at various times in the course of the year, of examining different wells in the town, which I found corresponded with the one I was keeping the journal from.

I am, Sir,
Your's, &c.
M. SAUL.
Lancaster, Oct. 26, 1827.

Depth of Water in the Well.

1826.	Feet	In.	1827.	Feet	In.
Oct. 19	—	6	June 2	3	4½
24	—	6	9	3	2
Nov. 9	—	9	16	3	1½
18	—	11½	23	2	11
Dec. 5	1	3	30	2	10
13	2	1½	July 7	2	9
18	2	10	14	2	6
26	3	11½	21	2	3
1827.			28	2	—
Jan. 1	4	2	Aug. 13	—	22½
8	4	3½	18	—	22
Feb. 8	4	7½	25	—	21
26	4	7	Sept. 2	—	19¼
Mar. 5	4	3	10	—	17½
12	4	3	16	—	16½
19	4	7	24	—	15½
April 4	5	5	Oct. 1	—	14
14	5	1	8	—	12
19	4	11	15	—	13
May 3	4	3	22	—	15½
12	3	10½	29	1	6
19	3	8	Nov. 5	1	8½
26	3	5½			

P.S. It appears that the springs have not been so low this year by six inches as they were last year.

THE THAMES TUNNEL.

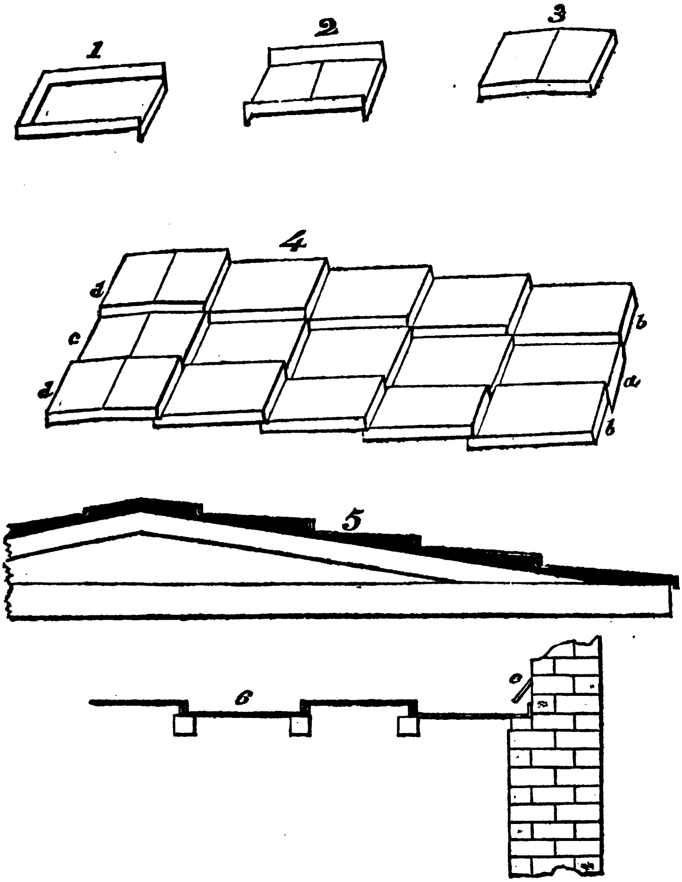
At a General Meeting of the Shareholders of this concern, held last week, they were informed that the tunnel ways have been, at length, completely cleared of the slush and water let in by the memorable accident of the 18th May last; that the work of excavation has been recommenced, and continued 25 feet beyond the point at which the interruption took place; that the soil is now good; but that the utmost amount of available

means now remaining to the Company is 27,000*l.*, while it is estimated that 135,000*l.* more, or 162,000*l.* in all, will be required to complete the undertaking. A subscriber asked how much had been the extra expense occasioned by the late accident? The Chairman answered, about 12,000*l.* It appears, therefore, that, independently of the loss incurred through the irruption of the water, the expense of the tunnel is now expected to exceed the original estimate by no less a sum than 135,000*l.*!! The contrast which this result presents to the language which was not long since used in a demi-official pamphlet* that appeared on the subject, is remarkable. "Let us suppose *an extreme case*," it was said, namely, "that we expend 250,000*l.*, which our Act of Parliament enables us to raise, the revenue of the Vauxhall Bridge (8,500*l.*) would give near 4 per cent., and that of the Waterloo Bridge (14,000*l.*) nearly 6 per cent. on that sum." Well! not only is the said "extreme case" realized, but a case extreme beyond all anticipation—250,000*l.*, and more than half as much again as 250,000*l.*, are required to complete the work. What, then, becomes of the 4 or 6 per cent. returns? On the increased capital of 385,000*l.* a revenue of 8,500*l.* will not yield an interest of 2½ per cent.; nor a revenue of 14,000*l.* so much as 4 per cent. And these anticipations of revenue, be it recollected, are *the very highest* which the projectors of the undertaking have ventured to indulge; the *actual revenue* will, in all probability, be for a long time *much less*.

Since it is pretty evident, then, that the present subscribers can have no inducement to sink any more money in the concern, and since Parliament will certainly not compel them to do so, how are the funds still wanted to be obtained? Must the work stop for lack of the ways and means? We will hazard a conjecture or two on the subject. Stop the work will not; and, suffer who may, it would be a pity that it should. But to raise the necessary funds, the claims of all the first shareholders will be postponed, in favour of a new set of speculators, who will advance the 135,000*l.* in the character of bondholders, and engross the whole proceeds of the tolls, till the 135,000*l.* is paid off, with 5 per cent. interest. And when will that be? Much about the same time, we should think, that the national debt is paid off.

Results of this description are common enough, we confess, but not the less *seriously* to be deplored; Fallacious estimates and fruitless investments cannot be of daily occurrence, without ultimately engendering a distaste for all sorts of public undertakings; while the facility with which the consequences of the grossest miscalculation may be got over, by such arrangements as that which is likely to take place with respect to the Thames Tunnel, is sure to induce not only heedlessness in those who make estimates, but neglect in those whose duty it should be to sift and examine them. A correspondent (D. P. F.), who has sunk 500*l.* in this tunnelling concern, suggests that the shareholders should form a committee of their number, to watch over any parliamentary proceedings that may be set on foot for the purpose of remedying the blunders that have been committed in regard to it. We do not see any good in this; as money must be borrowed to complete the work, and the lenders must of course be preferred before all other parties, the sooner the sanction of Parliament can be obtained for that purpose, the better. But a committee that *would do good*, would be one that would make it its business to ascertain whose fault it is, that so much more money is required than the shareholders and Parliament were led to believe would be amply sufficient, and how far past errors furnish a ground for future confidence.

* Origin, Progress, and Present State of the Thames Tunnel. *Effingham Wilson.*



The following recommendatory description of this roofing is from the pen of the Patentee himself; but it does not appear to us that truth and impartiality require any material deductions to be made from it.

Advantages of the Iron Roofing.

It is adapted to the covering of churches and other public buildings, as well as private dwellings and warehouses. It is particularly well calculated for the Grecian style of architecture, which requires the roof of a lower angle than can safely be given with any other than a metallic covering. The expense, compared with lead, is scarcely more than one-third; and deducting the charges for close boarding, indispensable for lead, which may be omitted altogether in the mode of covering proposed, the cost may be fairly quoted as *not more than one-third the expense of lead.**

* Comparative weights of different roof materials, as extracted from Tredgold's valuable work on the strength of cast iron:—

	lbs. per square of 100 ft.
Copper	100
Lead	800
Large slates . .	1,120
Ordinary ditto .	900
Ditto	500

By the contraction and expansion of metals in all changes of temperature, the lead is very liable to fracture, and particularly so when confined, or laid in long sheets. Carter's roofing being divided into figures of equal dimensions, the expansion or contraction is so equally diffused, and its quantity so divided, that no fracture can possibly happen from such cause.

Taking into account the quantity of lead used on slate roofs, upon the ridges and angles, also the charges for laths, copper nails, &c. &c., particularly on buildings of large dimensions, in which the double or M roofs are required; considering also the saving of materials in the diminished surface, occasioned by the low angle, the iron will not be of more cost than a covering of the best slate, over which it has likewise the advantage in being of lighter weight.

The slate roof may be calculated to last about fifty years; at the end of that period the old slate will be of no value, although the iron will in that time be scarcely deteriorated, and, in case of the final destruction of a building, the material, as old iron, will be worth nearly one-half the original cost.

The effect produced by the simple and regular form of the parts composing this covering, is peculiarly pleasing to the eye, which is relieved by the light and shade produced by the alternate projection, the apparent thickness, and the gradation of the plates. It also presents a field for the display of architectural taste, in such buildings of classical design, as require that a participation of ornament be continued to the roof; or that this part of the building be totally concealed from view.

Description of the Drawings.

Fig. 1. A plate with three flanges or laps turned up, and one turned down, and is called the Roof Plate; this form being used for covering the roof generally, excepting the ridge or centre row.

Fig. 2. A plate cast with two raised sides, and two sides depressed, and is named the Lower Ridge Plate.

Fig. 3. A plate cast with the four sides turned down, and called the Upper Ridge Plate.

Fig. 4. A bird's eye perspective view of a portion of a roof, as covered with the patent roofing. The row of plates marked *a* is composed with the roof plate, as seen in the drawing fig. 1. The rows of plates marked *b* are also made with the plates fig. 1, but placed in a position the reverse of that figure. The plate marked *c* is the lower ridge plate, fig. 2; and the plates marked *d* are the upper ridge plates described by fig. 3.

Fig. 5 is a section showing the inclination of the plates, and the use of the flanges by which drips are formed. The inclination need not exceed half an inch to the foot, and, with the drips, will together comprise a fall of 1½ inch to one foot.

Fig. 6 is a section at right angles with the preceding. When the roof is constructed within parapets, the gables may finish with the plates in the position of *a*, fig. 4, with a rail or drip fixed to the parapet, as at *e*, fig. 6. In the construction of penthouse roofs, the ridge plates are not required.

The Patentee recommends plates of three-sixteenths of an inch in thickness, and two feet square, clear of lappings, with flanges of two inches, as the most economic general size, twenty-five of which will cover a square of one hundred feet: as a matter of taste, any alteration in the dimensions may be made. The weight of the above will be about ten pounds per foot, or one thousand pounds the square. If made of a larger size, an increase of thickness will be required; and if of alternating dimensions, with one row or range of plates narrower than the other, a small increase of expense will be incurred, by the consequent increase of weight in the increased number of laps.

Stone slate	. .	2,380
Pan tiles	. . .	1,780
Ditto	. . . .	650

Weight of the proposed iron covering, 1,000 lbs. per square of 100 feet.

If desired, such ornaments as architectural taste may design can be added, and will involve only the additional expense of carving, moulding, and weight.

The Patentee is of opinion that his roof plates will require no fastening, and that their weight and peculiar construction will secure them against high winds; but should any architect (otherwise disposed to adopt or recommend this mode of covering) be doubtful of their security in this respect, he proposes to cast a ring or loop into the under side of the plates forming the row *b*, fig. 4, by which, with the addition of a hook or chain to each plate of this row, they can be fastened to the rafter. It must be obvious that the upper rows effectually secure the under.

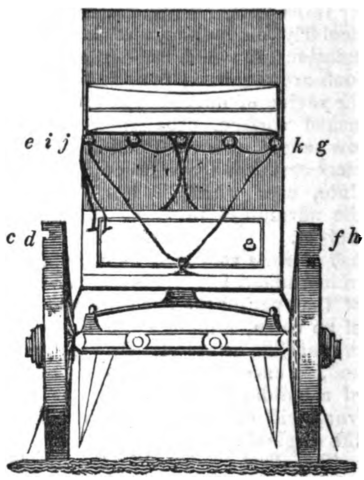
Price per ton at the Toll End Furnaces, Staffordshire, £11 10*s*.

Freight to London	. £1	10
——— Bristol . .	1	1
——— Liverpool .	1	1
——— Hull . . .	1	2
——— Gainsborough	0	18
——— Shardlow .	0	12

The Patentee has, we understand, established a manufactory for the supply of this sort of roofing at the Toll End Furnaces, Staffordshire.

IMPROVEMENTS IN WHEEL-CARRIAGES.

Sir,—It is now nearly two centuries and a half since coaches, first invented in France, and first made use of, if I recollect right, by a fat Dauphin, who was unable from his obesity to ride on horseback, were introduced into this country by Fitz-Allen, Earl of Arundel; but although, like many other imported inventions, they have attained with us a degree of elegance and convenience far exceeding any thing witnessed by the country that produced them, it must be confessed that W. D. (see p. 148, vol. viii.) does not complain without reason of their being still encumbered with many striking defects. I have been induced, by his remarks, and by a desire of alleviating the lot of that noble animal, the horse, which, next to the dog, I admire and respect before all others, to turn my attention to the removal of these defects; and have devised four plans for this purpose, which, with your kind leave, I shall lay before your readers. I trust they may prove beneficial, but I do not say they will; for there may be faults in them I cannot see, but which others may; should they do so, they will oblige me by pointing them out.



Plan I. *To prevent a coach from falling by the loss or fracture of one or more of its wheels.* Place under that part on which the body rests (or perhaps I shall better explain my meaning by saying, those two beams at each end of the coach, of which the wheels are the supports), iron work, as represented in the drawing.

Plan 2. *To prevent a coach from falling from any other cause than that of its wheel or wheels coming off, or breaking.* An iron rod, sufficiently strong, should be projected from the steps of each door, three quarters of a foot beyond the wheels, to within about half a foot from the rod *a*; all which may be plainly understood by inspection of the prefixed drawing. All the steps may be placed on the rod, which will make it more useful.

Plan 3. *To save the trouble of dismounting to lock and unlock the wheels.* W. D——s says, "Coachmen are sometimes unwilling to lose time by dismounting to lock and unlock the wheels, which, nevertheless, is necessary for safety to be done." To relieve them from this trouble, I will show them a manner in which the wheel may be locked and unlocked without troubling coachman or guard to dismount. The former need only stop the horses, the latter pull a string.

Suppose *c* the case of a bolt, *d* is fixed to the end of a bolt, from which go two strings or straps, *f* and *h*; *f* enters the ring *g*, and when pulled, I need scarcely say, will force the bolt out, and so lock the wheel; *h* enters the rings *e*, *i*, *j*, *k*, and lastly *g*, and when pulled, will of course force the bolt back, and unlock the wheel.*

Plan 4. *To relieve horses going down hill.* Construct the pole in such a way as to permit of the horses having the power to move it up and down for the space of ten or eleven inches. No instructions are necessary for an alteration so simple as this; any coachmaker can accomplish it. I will not say this would wholly obviate the misery which horses experience in descending a hill, which the remarks of Mr. D. show must be great; but any plan which tends, even in the smallest degree, to lessen the tortures of these serviceable, amiable, and noble creatures, should and will be adopted by every *practically feeling* and *grateful* man. Should it even inconvenience ourselves, yet, if it reduces *their* pain more than it does our comfort, it ought to have our preference.

D——s proposes the following query:—"How are the lightsome qualities of a coach to be preserved without detriment to the paramount principle of safety?" In the preceding plans, numbered 1, 2, 3, 4, I have laid down a few simple means by which the above-mentioned valuable coach-requisites may be obtained.

Plan 1 is applicable to every wheeled carriage; 2, to every four-wheeled carriage; and the whole four, to every coach.

I am, Sir,

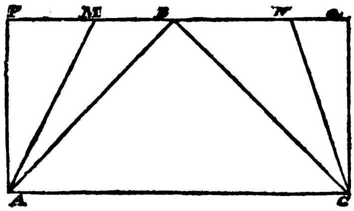
Yours faithfully,

J.

* The letters of reference in this paragraph have been omitted in our correspondent's drawing, but we have endeavoured to indicate their positions by marginal letters.—EDIT.

ON FINDING THE AREA OF A TRAPEZIUM BY MEANS OF ITS SIDES. (See No. 221, p. 279).

(From the French of our Correspondent F.)



Sir,—I first construct the triangle A B C; I then draw across the summit B a line parallel to the base A C; I afterwards suppose the sides A B and B C to be moved round the points A and C, till they assume the position A M C N, so as to form the trapezium A M N C. I finally suppose the same sides, A B and B C, to be moved still farther round, till they are perpendicular to the parallel sides, when they will form the rectangle A P Q C.

It evidently follows, that the trapezium A M N C has for its limits the triangle A B C and the rectangle A P Q C, which have the same base and the same height with it. Consequently, the rule (by Vyse) for finding the area of the trapezium, will be correct in the cases of the triangle and rectangle.

Suppose *p* to represent half the sum of the sides of the trapezium, and *a b c d* the sides, we have then, for the area of the trapezium,

$$\sqrt{(p-a)\,(p-b)\,(p-c)\,(p-d)}$$

In the case of the triangle there is one side less, and consequently $d = o$, which reduces the formula thus,—

$$\sqrt{p\,(p-a)\,(p-b)\,(p-c)},$$

as shown in "Legendre's Geometry," p. 296, edit. 11.

In the case of the rectangle, the parallel sides being equal, $a=c$ and $b=d$. The formula becomes then as follows:—

$\sqrt{(p-a)^2\ (p-b)^2}=(p-a)\ (p-b)=b.\ a.$ which is, in fact, the area of the rectangle.

I am, &c.

F.

A POPULAR INTRODUCTION TO ALGEBRA.

BY HENRY OTTLEY.*

The present publication, by our intelligent correspondent Mr. Ottley, is described in the title as being "designed chiefly for the use of mechanics, and such as wish to acquire an insight to the first principles of algebra, without the assistance of masters," and is appropriately dedicated to the President, Managers, and Members of the London Mechanics' Institution, as an attempt to "second their laudable endeavours to disseminate useful knowledge."

To the persons for whose special benefit it has been written, it will at once recommend itself by its extraordinary cheapness—the price being only one shilling. It has in this respect a decided superiority over all its predecessors, the lowest price of any of them being two shillings and sixpence. Many a poor but knowledge-thirsting mechanic will willingly give a shilling, who would ponder some time before he paid two shillings and sixpence.

A very complete vocabulary of technical terms precedes the body of the work. In treating of the various rules, the author, in order to impress them on the memory, and to make them intelligible to his readers, has appended to most of them one or more examples, which he works; explaining, at the same time, the mode of working and the reasons for each step as he proceeds. There can be no better substitute for the want of the familiar *vivâ voce* explanations of a master than this; and, as far as writing can do, it makes the matter plain and easy. The rules and explanations are, besides, almost always expressed in perspicuous language. He has, also, added proofs of most of the rules he has given. Of these, his proof of like signs producing plus, and unlike minus, is apparently original, and extremely plain and satisfactory. (See page 16, Art. 10.) His rule for the evolution of any root of a compound quantity, is also well given, and in part original. (See page 33, Art. 46.)

Mr. Ottley has, moreover, given variety enough; as he treats on Addition, Subtraction, Multiplication, Division, Fractions, Involution, Evolution, Surds, Simple and Quadratic Equations, and Arithmetical and Geometrical Progression and Proportion. The rules for these are fully given, and shown in practice; the work may, therefore, be safely recommended to mechanics as a cheap and easy guide to all these branches of Algebra.

At the same time, it is but fair to mention what we consider to be defects of some importance in this performance. In the first place, it is very carelessly printed; there are fourteen errata which the author has warned us of, and five or six more which he has not noticed. Page 21, line 13, he has $-\frac{16x^2}{2x}$, instead of $\frac{16x^2}{2x}-$; in page 37, line 13, we have $12\ {}^{12}\sqrt{x^{18}y^4}$, instead of $12\ \sqrt{x^{13}y^4}$; in page 32, Example 5, we have $\frac{x^2}{}$ printed for $\frac{x^2}{4}$; in page 38, Example 4, we have ${}^6\sqrt{a}\,7$, instead of $-{}^6\sqrt{a7}$. In page 43, Mr. O. has made some confusion in his rule for quadratic equations. The note which he places at the end of the rule ought to be added to the second step of it. In page 44, line 10, he directs to *complete the square*, yet has never mentioned *by name* this operation; so that the learner must be at fault.

---

* Steel, Paternoster-row. pp. 48, 12mo. price 1s.

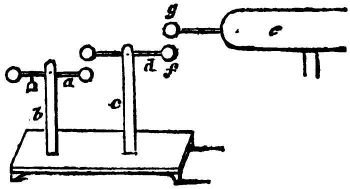
He also omits giving any reason for the rule for Subtraction, though it need not have occupied above two or three lines. A much greater fault, which candour obliges us to find with Mr. Ottley's work, is the paucity of examples. He has given us 40 rules, and but (including five miscellaneous examples at the end) 85 examples for practice, being at the rate of only two for each rule. He has not given one example for practice on Equations, or Proportion, or Progression. It is no sufficient answer, to say that he has given the rules by which to work the examples, if given; for, without containing the examples in itself, his book cannot fully answer the purpose for which it is intended; as the mechanic or other person, who buys it, expecting to make himself master of the rules treated of, will probably find himself compelled to buy some other book for the sake of the examples necessary for fixing the rules in his memory; and will find, when too late, that it would have been as well to have at first bought some other more expensive work, in which he might have had both rules and examples. Mr. O. would do well to publish an Appendix, containing as many well chosen examples as may be necessary for perfecting the work, and this at a small cost (say sixpence). It would then be at once the cheapest book of its class, and no ways inferior, in practical merit, to the very best and dearest.

DESIGN FOR AN ELECTROMETER.

Sir,—The following sketch represents, properly speaking, an electrical balance, for ascertaining, *by weight*, the exact intensity of any quantity of the electric fluid. The idea, I believe, is a new one, and perhaps some of your readers may be able to state objections to it, which have not occurred to

Your obedient Servant,
CANDIDUS.

a a are two brass rods, balanced in grooves in the uprights *b c*. At the ends of these rods are four brass balls. The furthest arm of the rod *b* is graduated, and to it is attached



a small weight suspended by a thread; *e* is a prime conductor of an electrical machine. When the cylinder of the machine is turned, the ball of the conductor *g* must be placed over the ball *f*; and the attractive force of the electric fluid, raising the ball *f*, depresses the one at the other end, which at the same time presses down the ball under it, and raises the arm of the rod with the weight: by nicely balancing the attractive force and the counteracting weight (which may be done by moving the weight on the graduated rod), we ascertain the intensity *in weight* of the electric fluid. The distance between *g* and *f* must be just sufficient to avoid the spark passing from one to the other.

INSTANTANEOUS LIGHT MATCHES.

Sir,—What I wrote before on this subject, I wrote from memory, but I have since endeavoured, for the sake of "W. A." and your readers, to gain what further knowledge I was able concerning these same matches.

In the first place, great difficulty will be found in *splitting* the wood, so as to form them into those neat little bundles which we see in the shops: all attempts to split the deal with a knife, or chisel, will be almost fruitless. I say *almost*, because one may, by perseverance, contrive to form about forty neat matches in the course of an hour or so, which, to me, seems rather a waste of that valuable article *time*. I rather think that the match-makers employ a kind of tool like a grooving, or very narrow plane, with the iron set coarse, so as to take off a long thin narrow strip, which is then cut into lengths. I

have seen these matches of card, but they do not answer nearly so well. The following are two receipts for the *composition*, which a very respectable chemist and apothecary was kind enough to give me. The first is, chlorate of potass (the same as oxymuriate of potass), 44 grains; nitrate of potass, 21 grains; flower of sulphur, 18 grains; vermillion, 2 grains; mix with spirit of wine. Be careful in mixing. My last directions (see vol. vii. page 183,) were perfectly right on this head. The next receipt is, lump sugar, half a drachm; oxymuriate of potass, 1 drachm; camphor, 12 grains; gum arabic, 3 grains; vermillion, 2 grains; spirit of wine, *quantum sufficit*.

Now, in making the above, I should recommend a small quantity of saturated solution of camphor in spirit of wine, to be made in the first place; for it is next to impossible to grind up, or triturate, the camphor with the other ingredients: then *separately* reduce to a fine powder your oxymuriate of potass, lump sugar, and gum arabic; then put them all together into a small mortar, cup, &c., and mix them into a kind of paste, by adding a certain portion of the saturated solution of camphor. It is in forming this paste that part of the secret lies; and I can here only speak from conjecture, but I imagine (and the gentleman whom I have mentioned above is of the same opinion) that the makers of these matches form the whole composition into a sort of *thick fluid*, or *thin paste*, like a syrup, and then dip the ends of the matches three or four times over, by which they acquire that clean, neat head, which the shop matches have. Between each dipping let each match dry. Perhaps W. A. may be able to get wooden matches split for him at the toy makers'. He may depend upon it all the materials which I have mentioned are correct; but the different makers of these matches, and other things in which this composition is used, have various receipts for making them.

I copy the following from "Griffin's Chemical Recreations," fifth edition, page 182:—"Instantaneous light boxes, sold by chemists, contain a little phial filled with a liquid, and a number of small matches. You take a match and dip it into the liquid, upon which it takes fire. The *liquid* is concentrated sulphuric acid. The bottle containing it is never opened, except when it is to be used; for the acid, when exposed to the air, imbibes moisture very rapidly, and is soon spoiled. The *matches* are prepared as follows:—The ends of some small slips of wood are dipped into a strong solution of gum, and afterwards into the mixture of chlorate of potass and sulphur, prepared as described at 591.* The powder is fastened to the wood by the gum, and the matches, when dry, are fit for use."

The dipping the sticks of light wood first into a strong solution of gum, and then into the powder, may, perhaps, answer well; but I conceive that the gum ought to be mixed with some inflammable body. Perchance, isinglass, boiled in spirits, would make a good kind of gum for this purpose. A solution of gum in *camphorated* spirit of wine, perhaps, would be still better.

I strongly recommend the perusal of J. Griffin's little book (which I have just quoted) to W. A., and your readers in general: it is a cheap [3s.] intelligible work on chemistry. Griffin begins his preface thus:—"To the Members of the Mechanics' Class of the Andersonian Institution, Glasgow.—Gentlemen, The following work, written by one of your number, was undertaken for the purpose of furnishing, to junior students of chemistry, a *text book* at a moderate price," &c. This sufficiently explains the nature of the work, and it fully answers the purpose intended.

Mr. Joyce, chemist, of Old Compton-street, Soho, sells neat little chemical chests, for small and amusing experiments, at 30s. each chest, accompanied by a pamphlet, wherein I find the following:—

* The mixture, as described at 590-1, is, two grains of chlorate of potass, and *one* grain of sulphur; mix them accurately, by well triturating them in the *gentlest* possible manner.

"*Experiment* 47.

"A paste, made of 18 parts of chlorate of potass, 3 of *sugar*, and 3 of *sulphur*, with a little vermillion and gum water, forms the composition of the instantaneous light matches, that inflame by being touched with sulphuric acid."

I remain,
Your obedient Servant,
F. B.

PUMP QUESTION NO LONGER QUESTIONABLE.

Sir,—None of your numerous readers can have a greater antipathy than myself, to see the valuable pages of the Mechanics' Magazine occupied by "useless discussions;" I shall therefore, as briefly as possible, reply to the communication of Mr. Ottley, at page 278.

To the direct question in his second paragraph, I reply, "my authority" for my former assertion is the established principles and *unalterable* laws of the science of hydrostatics. And whether the feed pipe of the pump end within a few inches of the surface of the stream, or any distance below it, whether it be straight or *bent*, the water will rise within it to *the level of the external water, and no higher*, and from that point the action of the pump will commence.

If the force of the stream *x*, *assumed* by Mr. Ottley, is equal to a pressure of 15 lbs. per square inch, his hypothesis will hold good, *but not otherwise*. I make this assertion on my *before-mentioned authority*. With these observations, I take my leave altogether of the pump question, and remain, Sir,

Yours respectfully,
W. BADDELEY, JUN.

Nov. 19, 1827.

HAMMERSMITH BRIDGE.

Mr. Editor,—In number 222 of the Mechanics' Magazine, you give a description of the Hammersmith Chain Bridge. With your usual candour, you will, no doubt, in your next, do me the favour to state that the whole of the works were executed from the designs of Mr. Tierney Clark, Engineer to the Company, under whose direction the structure has been completed; and that Capt. Brown was not the Contractor for erecting the bridge, but only for making and fixing the chains. The principal part of the iron work was, as you have stated in detail, made at Messrs. Walker's, Gospel Oak, under the direction of Mr. Yates, and at the Brierly-hill Works, under the direction of Mr. Harrison.

I am, Sir,
Yours, &c.
A SUBSCRIBER.

PRACTICAL FRUITS OF THEORY.

The celebrated Lavoisier, actuated by the benevolent desire of demonstrating to his countrymen the importance of attending to scientific principles in the cultivation of the soil, undertook himself the management of 240 acres in La Vendée. In *nine* years he *doubled* the produce of the farm, and his crops were generally one third larger than those of his neighbours.

GOUT SPECIFIC.

Dr. Perkins, of Coventry, states, that the *common* hedge hyssop forms the basis of the celebrated Eau Medicinale, and that the recipe was given him by Count Leiningen, who paid 500 ducats for it. This nobleman was a person of extensive reading, and a munificent patron of the arts, and had been in early life a martyr to the gout; an exemption from which for several years, he attributed to the use of this medicine. —*Stevenson and Churchill's Medical Botany.*

THE STUFFING OF SADDLES.

Sir,—There are few things in which improvement is more wanted than in stuffing saddles. As now made, they very frequently injure the back of the horse, and, if often used, are never dry. I am sure a clever man might make a fortune, by inventing a lining free from those objections. Perhaps the object

might be attained by two pieces of strong and moderately thick leather, placed between the tree and flaps, next to the horse's skin. They might be made either fixed to the tree, as the present pads are, or to take in and out. They would have many advantages—coolness, durability, &c. I am aware that J. Cooley, Cockspur-street, has invented, or is now selling, saddles with the pad to take out; but as they are made of flannel, they are not free from the above objections, although certainly an improvement upon the old plan.

I am,
Yours obediently,
C. R.

EXTIRPATION OF THISTLES.

Sir,—The variety of information communicated through the medium of your valuable miscellany, induces me to request that some of your agricultural readers will inform me how *thistles* may be effectually extirpated. In a field immediately under my drawing-room windows, these intruders have within the last three years spread themselves with the greatest luxuriance, in spite of every means adopted for their destruction; and, unless I can compass it, the field will be useless as a pasture, except to "donkies." The soil is by no means poor, and has had a fair portion of manure; and what renders this visitation more extraordinary is, that all the surrounding land is perfectly free from this unprofitable plant.

Your old Friend,
S.

Norwood, Nov. 5, 1827.

BED-ROOM STOVES.

Sir,—Any of the readers of the Mechanics' Magazine would confer a great benefit on their country, if they would invent a small stove, which might be put into the grate of a sleeping room, which would warm the room and be free from smoke, and not require constant attendance, as a fire in a grate does. Charcoal cannot be admitted with safety.

C. R.

LIST OF NEW PATENTS.

James Smethurst, of New Bond-street, in the county of Middlesex, lamp manufacturer, for an improvement or improvements upon lamps. Dated 6th November. *(Two months.)*

Frederick Foveaux Weiss, of the Strand, in the city of Westminster, surgical instrument maker, for his invention of certain improvements in the construction of spurs. Dated 6th November. *(Two months.)*

James White, of Paradise-street, Lambeth, in the county of Surrey, engineer, for his invention of a machine or apparatus for filtering, which he denominates an artificial spring. Dated 6th November. *(Two months.)*

John Platt, of Salford, near Manchester, in the county of Lancaster, fustian dresser, by virtue of certain communications made to him by a foreigner residing abroad, for an invention of which he is in possession, of certain improvements in machinery for combing wool and other fibrous materials. Dated 10th November. *(Six months.)*

William Collier, of Salford, in the county of Lancaster, fustian shearer, in consequence of certain communications made to him by a foreigner residing abroad, for an invention of certain improvements in the power loom for weaving. Dated 10th November. *(Six months.)*

John Walker, of Weymouth-street, in the parish of St. Mary-le-bone, in the county of Middlesex, Esq. for his invention of an improved castor for furniture. Dated 17th November. *(Six months.)*

NOTICES TO CORRESPONDENTS.

Mr. Pringle's paper on Electrical Conductors is unavoidably deferred till our next.

Communications received from $\frac{10}{26} + \frac{13}{26}$ W. M.—W. H.—Typo—J. P. H.—Mac Ambuiler—Mr. Tonkin—S. C. Todd—Mr. Shalders—Mr. Carstairs—Mr. Utting—Mr. Crosbie—Juvenis—Bolnhurst—G. B.—P. J. L. G.—Ignoramus—J. S. T.—Mr. Cox—J. O. B.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

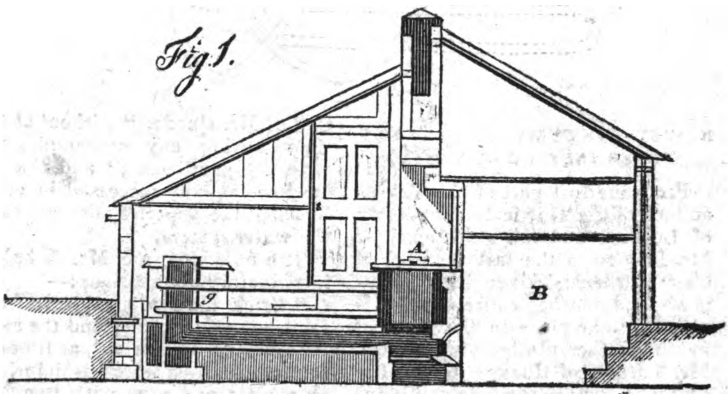
No. 225.] SATURDAY, DECEMBER 15, 1827. [Price 3d.

"The ancients effected all that could be accomplished by men who lived in the infancy of time; the Eagle of Science could not soar until her wings were grown."

COLTON.

NEW SYSTEM OF WARMING.

Fig. 1.



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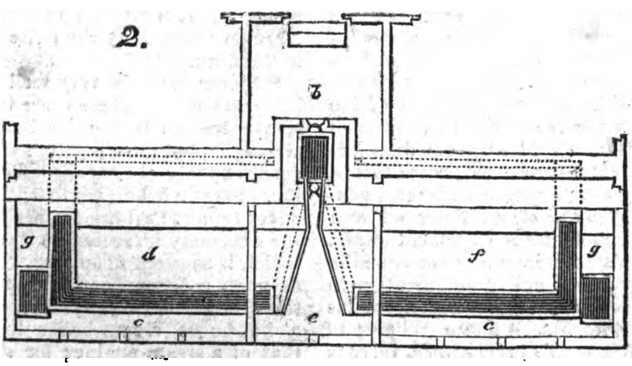

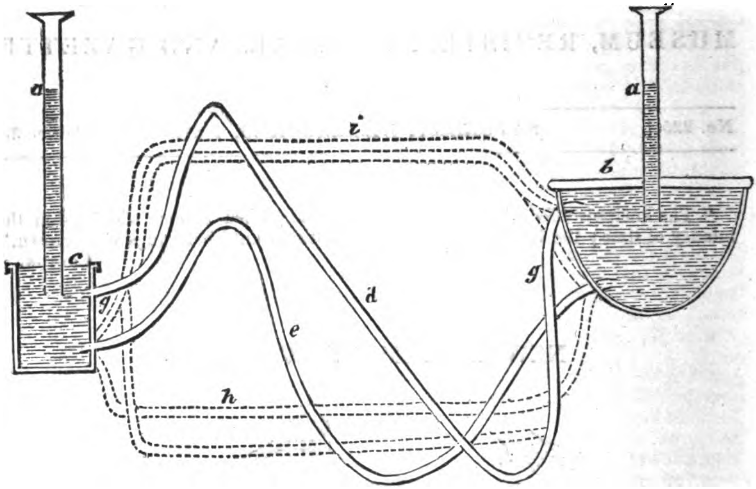

NEW SYSTEM OF WARMING BY HOT WATER INSTEAD OF STEAM.

From the last part of the Transactions of the Horticultural Society of London, and the statements of Mr. Loudon in the last Number of his "Gardeners' Magazine," it appears that another entire change is about to take place in the mode of heating conservatories, vineries, &c. Mr. Turner, of Rooksnest, was the first who, by his example and influence, led to the general adoption of the plan of heating by steam, about eight years ago. Since then, Mr. Anthony Bacon, F. H.S., and Mr. Atkinson, the eminent architect, have, without any knowledge of each other's plans, made trials of hot water instead of steam; and have proved its superiority so incontestibly, that Mr. Turner himself has been one of the foremost to recommend its universal substitution. Mr. Loudon does Mr. Turner no more than justice in noticing, with approbation, "this gratifying proof of an enlarged and liberal mind." A statement of Mr. Bacon's experiments is contained in a very intelligent communication to the Horticultural Society, from his gardener, Mr. William Whale; of Mr. Atkinson's proceedings, there is no other account than that he made use of a "similar apparatus" to that of Mr. Bacon, "without at the time having any communication with that gentleman;" and that he has been equally successful in establishing the superior advantages of the water system.

The following are Mr. Whale's introductory observations:—

"Brick flues are subject, from their numerous joints, and the mortar cracking, to give out, at times, a sulphureous gas, which is injurious to plants; and even with two fireplaces, in a house forty or fifty feet long, it is impossible to keep up an equal temperature in the whole length. The houses get overheated in the neighbourhood of the fireplace, and it is difficult to maintain a proper warmth at the extremities of the flues.

"Steam may do very well on a larger scale, and where there is constant attention to the fire both day and night; but the objections are, the great expense of a steam-boiler and the apparatus belonging to it; the frequent repairs that are required; and the necessary attention to the fire, which is as great upon a small scale as upon a large one: besides this, there is greater risk of explosion in a hot-house steam-boiler than in that of a steam-engine; for steam-engines generally have persons properly instructed to manage them;

but gardeners, or their assistants, cannot be so competent.

"The heating with hot water has none of the objections I have mentioned as belonging to flues and steam. The apparatus is simple, and not liable to get out of order. The boiler has only a loose wooden cover; and no safety-valves are required. The fuel consumed is very moderate; and when once the water is heated, very little attention is wanted; for it retains its heat many hours after the fire is gone out."

Mr. Bacon's garden at Elcot contains four houses for vines and peaches, and also a pine pit, heated with hot water. Mr. Whale gives the vinery as a specimen of the mode in which this is effected.

"The house (see the prefixed sections, fig. 1 and 2) is forty feet long, and ten feet wide inside, heated by a boiler A, placed in a recess in the centre of the back wall; the fire-place under the wall is got at from a back shed B. The boiler is two feet six inches wide, and one foot eight inches deep. From the end of the boilers proceed, horizontally, four cast-iron pipes, of three and a half inches diameter, *g;* two of them are joined to the boiler just above the bottom, and the other two directly above these, and just below the surface of the water. The house is divided by glazed partitions (see fig. 2) into three compartments, *d, e, f,* for the convenience of forcing one part without the other. The middle compartment is two lights in width, and the other two have four lights in each. The pipes from the boiler go horizontally to the front of the house, where one upper and one lower pipe branch to the east compartment, and two other pipes to the west, and are carried to the ends of the house, along the sides of the flues, where they unite to cast-iron reservoirs at each end of the house, *g g,* which reservoirs are each three feet six inches long, one foot six inches wide, and one foot eight inches deep, having iron covers. These reservoirs are filled with water, that communicates by means of pipes with the water in the boiler.

"When the boiler, pipes, and reservoir, are filled, and a fire lighted under the boiler, the heated water, ascending to the top of the boiler, forces its way above the upper pipes to the reservoir, the cold water finding its way back to the bottom of the boiler through the under pipes; and the circulation continues regular as long as there is any heat under the boiler; the hot water flowing through the upper pipes to the reservoir, and as it cools returning back to the boiler through the under pipes. I have repeatedly, after the water has been heated, immersed a thermometer in the reservoirs at the end of the house, and have only found a difference of three or four degrees between that and the water in the boiler. It is not necessary to make the water boil; and, if the fire is judiciously managed, no steam will be raised, and no water wasted. It is, however, necessary to examine the boiler occasionally, and to add water when any has evaporated.

"Valves might be fixed in the boilers, pipes, and reservoirs, for letting steam into the house, if required; but that would induce the necessity of boiling the water, and it has not been done here, as I find I can produce all the steam I require, with little trouble, by watering the pipes with a watering pot.

"I am persuaded that the advantages of this mode of heating, with its great simplicity, will give satisfaction to every practical gardener who has an opportunity of trying it. When once the water is heated, and the fires well made, he may retire to rest, certain that the pipes will not get cold during the night, but retain a considerable heat in the morning."

Mr. Loudon, that he might be able to form an opinion on the subject from personal observation, paid a visit to Deepdene and Rooksnest, in Surrey, and Bickley Place and Sundridge Park, in Kent; at all which places there are hot-houses warmed by water on Mr. Bacon's

plan—in some cases with a little variation. The following is the report he gives of his observations.

"At Deepdene, an orangery is heated by the circulation of water through iron pipes, without the addition of a cistern, the reservoirs of heat which that addition would supply being considered unnecessary. At Rooksnest, on the evening of September the 27th, we examined two pits heated in this way, and marked the progress of the circulation of the heated water, which, with a moderate fire, proceeded at the rate of two feet in a minute. On returning to these pits on the following morning, though nothing had been done to the fire after nine o'clock the preceding evening, we found the pipe still warm. The gardener, Mr. Squib, a very superior cultivator, who has filled his situation, at Rooksnest, for several years, and has had extensive experience both with steam and smoke, entirely agrees with Mr. Whale, in his preference of the water system to every other. At Bickley, near Bromley, two houses are heated by water from one boiler, each house having a reservoir at the end opposite to the boiler; in one house the pipes used are of earthenware, the joints cemented with Roman cement, and perfectly water-tight. The gardener, Mr. Wells, of superior abilities in his profession, is as much in favour of water as Mr. Squib, and considers earthenware pipes as perfectly sufficient; and perhaps, in some cases, superior to metal, from the general though almost invisible moisture which exudes through the pores of the material. At Sundridge Park, an extensive conservatory and two vineries are heated by hot water, which is impelled through the pipes to a certain extent by the expansive power of the steam in the boiler. This work is believed to be the invention of Count Chabbanes: it is very ingenious, and deserves to be recorded as one of the first steps in the progress of heating by hot water; but the mode described by Mr. Whale is so superior, so much more simple and economical, that it is not likely Chabbanes's method will ever be repeated. The kitchen gardener, Mr. Thomson, understands both methods perfectly; prefers that of Mr. Whale; and has constructed a model for heating a vinery, by Mr. Whale's method, where the pipes must pass under a foot-path considerably below the level of the boiler."

In order to make it more evident, that if the height which the water stands in the boiler and the reservoir be equal, and as high as the highest part of the pipes, the circulation between them will take place, however low the pipes may descend, Mr. Loudon has given the following illustration:—

"If the covers of the boiler and reservoir be fixed and water-tight, a perpendicular pipe from each (see fig. p: 338), kept filled to the proper height, will have the same effect as if the full dimensions of the boiler *b* and reservoir *c* had been so extended. The pipes between a boiler and reservoir so adjusted, may be conducted in any direction, and ascend and descend at pleasure, or in the most irregular manner, so that they never rise higher than the level of the water in the boiler and reservoir *a a*. The cold-water pipe *e* and warm-water pipe *g*, provided they proceed from the boiler and enter the reservoir, the former lower than the latter, may be placed side by side in the space to be heated, either under the path of a hot-house *h*, or so high as to be out of the way of plants, or persons walking in the paths."

It was mentioned by Mr. Wood, of Deepdene, that a considerable *saving of fuel* is obtained by this method of heating. "We could not," says Mr. Loudon, "conceive how there could be much difference in this respect; but on since looking over some papers in the Mechanics' Magazine, Nos. 211, 212, and 213, by Mr. Gilman, Civil Engineer, we are inclined to think this may be accounted for, at least as compared with heating by steam, from the circumstance of more heat being

frequently generated to boil water, than the water in that state can take up. In heating by hot water, the water seldom exceeds 150°, and at that temperature it would appear to have a greater capacity for taking up heat, than either in a cold or boiling state." We are not altogether satisfied with this explanation; and think that the saving may as probably be ascribed to the fact, that when steam is used, much more of it is ordinarily generated than there is any occasion for, (pipes of the same capacity serving for steam of all densities;) while, in the case of water, the pipes, when *once filled, admit of no addition.*

Since heating by water is so efficacious in the case of hot-houses, it must be equally applicable, we should think, to houses and buildings of every description. The pipes need not be above an inch in diameter, and may be so bent and concealed, as not to obtrude in the least on the view.

Mr. Loudon is probably right in predicting that steam will "at all events never again be employed in gardening as a medium of heat."

GAS LIGHTING.

Mr. Matthews, whose "Historical Sketch of Gas Lighting" we noticed two weeks ago, has produced, simultaneously, a practical companion to it, entitled, "A Compendium of Gas Lighting, adapted for the Use of those who are unacquainted with Chemistry, and containing an Account of some new Apparatus lately introduced."

We were, at first sight, inclined to condemn this separation of the historical and practical parts of the subject, as inconvenient and unnecessary; but finding, on examination, that the author has by this means been enabled to embody all that relates to the present practice of gas making and lighting, in a small 12mo., which costs only 4s. 6d., though consisting of 134 closely printed pages, and illustrated by two copperplate engravings, numerous wood cuts, and several elaborate tables; we are constrained to confess, that he has in this respect done wisely.

A great number of persons are now concerned in gas making and lighting; and among these there must doubtless be many whose circumstances it will suit well to be able to purchase, by itself, the information of which they are more immediately in want. So *cheap* a guide to the present practice of the gas manufactories has never before been published; and though the instruction of the operative gasman has not been quite as much studied as we could have wished, the work deserves also the praise of comprehending a great variety of most useful details, conveyed in clear and simple language, and explained, where necessary, with an ease and distinctness which are the fruits only of knowledge and experience.

Among the most remarkable *novelties* of the book are Mr. Matthews's accounts of the *Tell Tale*, (which shows the quantity of gas generated every hour in any manufactory, however large); the *Pressure Indicator;* the *Apparatus for Registering the Impurities of the Gas;* and the *Instrument employed for ascertaining the Specific Gravity of Gas;*—all recent inventions of Mr. Samuel Crosley; who appears to have done more by his well-conceived and well-executed plans, to give the manufacturers of gas a perfect command over their business, than almost any other individual. "Heretofore," says Mr. M. "no description of these useful and important additions to gas apparatus have been published." To the same individual, it seems, the public are also mainly indebted for that singular and ingenious machine, the *Gas Meter;* for "though the first contrivance of measuring the gases by means of a machine is due to Mr. Clegg, yet the original invention has been matured and very materially improved by Mr. Crosley." The following is our author's description of this wonder-working machine:—

"The Gas Meter has undergone the practical test of several years; and experience has proved its ad-

vantages both to consumers and proprietors. It is now very extensively used at most of the Gas Light Establishments in the United Kingdom; and the regularity and accuracy with which it effects its purposes, at once demonstrate its ability and excite admiration. It obviously tends to render gas lighting more general, because it enables the consumer to light up his house in any way, as occasion may require, without being subject to the inconvenience of burning the gas only at fixed periods; while the Gas Companies have the satisfaction of knowing that the gas consumed is registered by the meter.

"The construction of the gas meter is rather complicated, even in its most improved state, and would require several figures to represent its various parts; but it is presumed that the subsequent description, with the aid of the figure, which is a section of it, through the middle of the drum, will render its principle and operations easily understood.

"The interior consists of a hollow wheel or drum, which is divided by the plates *c c c*, into the several compartments 2 3 4; and it revolves on its axis in an air-tight case, which is rather larger than itself; and both the case and the lower compartments of the wheel are filled with water to a little above the axis, 5. Each compartment has two apertures, *z d*—one for admitting the gas, the other for discharging it; and these openings are placed in such situations, that at the time the gas is entering into one compartment, its outlet is beneath the surface of the water. 6 is the pipe by which the gas passes to the burners; and 7 shows the space between the outer case and the drum. Thus, the gas being conducted into the meter at the ordinary pressure given it by the gas holders, the wheel is made to revolve by the filling of the compartments in succession; and by this operation the compartment which is previously filled discharges its contents into the outer case, whence it passes off to the burners, to be consumed. As the entering in and escape of the gas occasion the hollow wheel to revolve, its axis at the same time communicates motion to a series of wheel work, which registers, by its revolutions, the exact quantity of gas that passes through the meter. In fact, the operation of the meter is so efficient for all its purposes, that, by inspecting the index, the precise number of cubic feet expended may at any time* be known either by the consumer or by the Companies.

"This imperfect description will, it is hoped, clearly evince the ingenuity exercised in the contrivance of the gas meter, and elucidate both its principle and action. Its superior merit has been proved by the accuracy of its results in extensive practice; and in proportion as it is nicely examined, will its great utility be duly appreciated."

Another novel section of this work, which we are tempted to quote, is the author's account ("from an original communication") of the process, invented by Mr. Archibald Cook, of converting into gas the tar residuum which remains after the first distillation of coal.

"As the quantity of tar produced by the distillation of coal is considerable, various plans have been employed to convert it into gas; but Mr. Archibald Cook, of the Paisley Gas Works, has introduced a method

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* Even, we believe, to the extent of a year, half year, or quarter.—Edit.

which has proved very successful. The retorts are constructed and are fixed in a similar manner to those in an oil gas apparatus; and the vessels which contain the supply of tar for decomposition are two wrought iron cisterns of different dimensions, placed one over the other, three feet above the brick work where the retorts are set. The upper cistern, called the reservoir, is the largest, being about four feet square; the lower one is only half that size, and is attached to the bottom of the other, to act as a regulator. In the bottom of the large cistern there is a valve, to which a float in the regulator is connected by means of two small rods and a beam; the use of this is to produce such an equal pressure, that the flow of the tar may be preserved uniform; and at the points where the pipe which conveys the tar to the retort enters the brick work, a small malleable iron filter or funnel is placed on a fire-tile having an orifice to receive it. The flue containing the tar-pipe is constructed expressly for the purpose of keeping it warm by means of a current of hot air, which is generated by a very small coke fire; and the pipe is fitted with a stop-cock, for regulating or shutting off the supply of tar, as occasion may require. The tar is permitted to flow only in a very small stream, so as to fall upon a cast iron plate about ten inches square, to be decomposed; and the retorts are heated to a proper temperature before the tar is introduced. The square cast iron plates are changed every twelve hours; and the process has proved not only effective, but is attended with little expense.

"Mr. Cook has shown the advantages attendant upon this plan, by more than two years' practice. He states, that when he first commenced the decomposition of coal tar, the cost of fuel was upwards of 60 per cent.; but since then, it has not exceeded 7½. He has carried on his operations with double and single retorts, and found both to answer equally well."

Mr. Matthews has our best wishes for the success of both his publications. They do great credit to his industry, judgment, and discrimination.

ON THE SOLUTION OF IMPOSSIBLE QUANTITIES.

Sir,—Your correspondent, G. S., having written his "Recantation," in No. 217, every one must have thought that he intended to say no more on the subject of the "Multiplication of Impossible Quantities;" but every one was mistaken; for in Number 220, he says, that he has "some misgivings," and, in consequence, shows some rebellious inclinations towards me, whom he had been so kind as to dub his "noble commander."

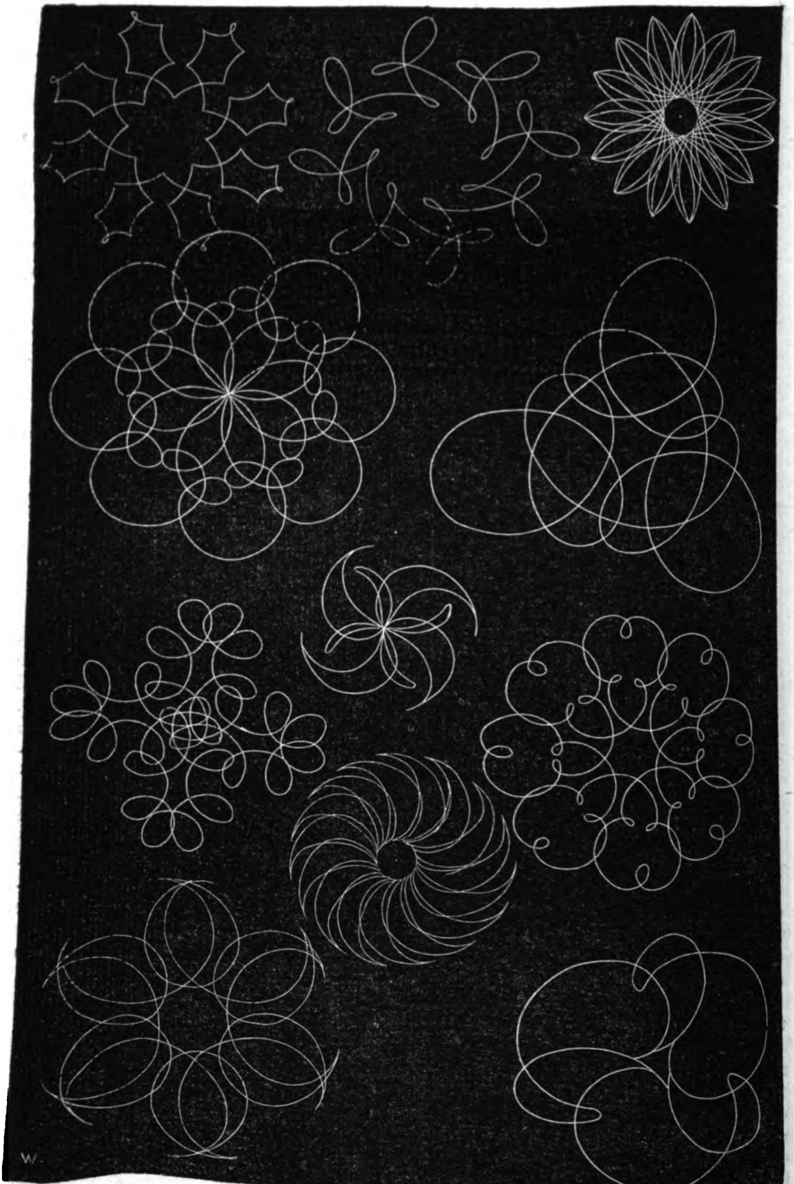
Mr. G. S. is mistaken when he supposes that I mean to say that the product of $\sqrt{-3} \times \sqrt{-3}$ should be taken $=+3$ in practice. All my object was, to show that it was *mathematically correct*, and that, according to *strict mathematical principles*, Mr. Darley was right in stating $\sqrt{-a} \times \sqrt{-b} = \pm\sqrt{a\,b}$. I am aware that one of these solutions must be *impossible;* for it would be absurd to suppose that they would both bring out the same answer. But in cubic equations which have impossible roots, each of these impossible roots have two products—the one *possible*, and the other *impossible*. In taking the imaginary product, however, the *impossible* value of the imaginary root is preserved. Thus, in the example before us, $x=2=-1+\sqrt{-3}$, the quantity $\sqrt{-3}$ has an *impossible* value; for if $2=-1+\sqrt{-3}$, then $3=\sqrt{-3}$. The impossible cube of $-1+\sqrt{-3}$ is $-10+6\sqrt{-3}=8$; from this, $6\sqrt{-3}=18$, or $\sqrt{-3}=3$, which is the *original* impossible value of $\sqrt{-3}$. In this way the "misgivings" which Mr. G. S. has experienced may be satisfactorily removed; and bidding himself, Mr. Russell, and the subject, farewell,

I remain, Sir,

Yours, &c.

HENRY OTTLEY.

ON THE GENERATION OF LINES BY CONTINUOUS MOTION—MR. JOPLING'S SEPTENARY SYSTEM — AND MR. IBBETSON'S GEOMETRIC CHUCK.



The same circumstance which gave occasion to the delay in noticing Mr. Jopling's Pamphlet on his Septenary System (see No. 223,

p. 314), has been the cause of the first of the following letters from Mr. Child not being sooner inserted. As it advanced claims which interfered with those of Mr. Jopling, we thought it but fair to refer it to the same friend who had undertaken the investigation of Mr. Jopling's labours. Since the appearance of our 223d Number, it has been returned to us by our friend, with a note, in which he laments the delay of which his unfortunate illness has been the occasion; and adds, that "the justice which it was his intention to have rendered Mr. Child requires that his papers should be now immediately inserted."

Sir,—In your valuable Miscellany, occasional inquiries are made respecting the art of "ornamental turning;" would you permit me to draw the attention of those correspondents to a sister art of more ancient date, and from which the above art borrows every embellishment, and almost every improvement? I have a clumsy instrument (or rather a model for one), invented and made by me about the year 1787, which, by giving a circular motion to the handle, may be made to produce *thousands* of figures, all very materially different from each other, and of almost any dimension, at pleasure. Ellipses of every proportion, of the smallest size, and in various positions, as concentric and parallel, or at different angles, may be described by it. About the above period, other engagements requiring my attention, it was laid aside, and remains, almost as it was, unfinished, and, as may be expected, very imperfect.

To an amateur in the arts, or to the man of science, it might afford ample scope for leisure hour amusement: to the former, by describing the figures; to the latter, by investigating them, finding the nature and properties of their curves, and determining by what arrangement a given figure may be produced. But such an instrument may have been made, and I, who have not been conversant with those matters for so long a time, or acquainted with any one who is, not know. Had there been such a medium as the "Mechanics' Magazine," through which knowledge is widely diffused, this communication might have been made forty years ago: but there were then no such desirable facilities, nor any person within the little circle of an individual's acquaintance, who either knew or cared any thing about such a *hobby-horse:* it may be packed in a box about nine inches square, and two deep; but an artist might make one that would not require more than half that space.

Inclosed are a few of the less complicated figures, very imperfectly drawn; some with a common pencil, others with an ordinary pen and ink: they may serve to give some idea of what the instrument might do, if put into a better state; and an engraving might be made from any of them, to appear, if deemed worthy of a place in your excellent publication, along with these unconnected hints. (See a selection of them in the prefixed engraving.)

I am, Sir,

Your obedient Servant,

K. Child.

Shaw-lane, Halifax,

Dec. 19, 1826.

Sir,—The 52d Part of the "Mechanics' Magazine" is now come to hand, and contains a further account of Mr. Ibbetson's Geometrical Chuck. Would you permit me, through the medium of your Magazine, to inform that gentleman that I am in possession of the model for an apparatus (the same referred to in my communication of the 19th December last) which may be made to produce any of the figures he offers to the attention of your readers: and, as I humbly conceive, a great variety of others much more intricate.

He appears to imagine the elliptical epicycloids with *equal* and *equidistant loops*, to be *new* things; but I can assure him that they are, at least, forty years old. As stated in my last to you, the above model was made in the year 1787, but, for reasons assigned, never completed.

If Mr. Ibbetson should ever happen to be at Halifax, in Yorkshire, I will with pleasure produce the apparatus for his inspection, in the unfinished state in which it has so long remained.

I am, Sir,
Your most obedient Servant,
K. CHILD.

Shaw-lane, Sept. 5, 1827.

Sir,—Would you allow me a corner in your valuable work, to inform Mr. Jopling how much I was gratified by perusing the partial account, which he has already given, of his "Septenary System."

By referring to my preceding communications to you, respecting an instrument for producing geometrical figures, it may be seen that I paid some little attention, when only a youth, to the producing of curved lines by means of moving planes, points, and right lines. I could then have performed what Mr. J. mentions in your Miscellany, by instruments constructed on that principle; but, through the lapse of almost half a century, many of them have been lost, or destroyed: however, a small part is still remaining. But Mr. J. has, undoubtedly, carried the thing to a very great extent, and also reduced it to a systematical arrangement: mine was but a mere juvenile attempt, and broken off even in the very outset. From what Mr. J. says, it appears that but few persons have an instrument (or could use one, if possessed of it) for drawing spirals or volutes with a variation in the curvature. As Mr. J. intends to publish a work on this subject, I could wish *only to say so much*, respecting an instrument which I made more than forty years since, as may serve to satisfy him that it will draw such figures. The connecting or trammel-rod was divided into equal parts; and the lever or arm, which carried the trace or pencil, was also divided by the same scale: in using it, the lever was moved the same number of divisions as one of the centres was moved; and the other centre was moved just double the number of divisions, or as many as both the others (viz. the *lever* and the *former centre)*. Although this may appear a little obscure to others (as it is intended it should do at present), I am well aware that Mr. J. will very readily understand it. Wishing this gentleman every possible facility in his undertaking, I do assure him, if I should live to peruse his publication, although I have been so long a stranger to these amusements, it will revive a solitary pleasure, enjoyed by me when very young; and, if he has similar feelings, in pursuing this subject, to those which I then had, his mental gratification will not be of the ordinary kind.

I am, Sir,
Yours respectfully,
K. CHILD.

Shaw-lane, Oct. 4, 1827.

Note.—I could wish to ask Mr. Jopling, if he has a method of moving trammel centres till they *become concentric?*

LOCK FOR BOOKS AND PORTFOLIOS.

Sir,—Being some time back applied to, to know if I could contrive or invent a small lock or locks to apply to books, or portfolios, I have succeeded in completing a model, which is very much approved of by those gentlemen who have seen it, who, I am proud to say, are of the first respectability: and I might have had orders for as many as I chose to make; but I declined executing them, being desirous of selling the model to any person who might wish to take out a patent. The lock is of the following description:—

In size, of an inch, or a quarter of in inch, if required. If wanted for books, of a superior quality of workmanship, and so constructed, that it is impossible it can be picked or opened by any other than one key. If required for portfolios, it may be so made in respect to the hasp which the bolt of the lock presses, that it will expand or contract according to the contents. A large one will require three locks, and one key

will unlock them all, though applied differently. The key may be worn on the watch-chain. Locks of this kind might also be applied to delicate cabinet work, such as jewel-cases, note and cash boxes, note-books, &c.

The insertion of the above will oblige, Sir,

Your humble Servant,
P. J. Le Gros,
Clock and Watchmaker,
Upper Crown-street,
Westminster.

P. S. Only letters post paid, with real name and address, will be attended to.

ON ELECTRICAL CONDUCTORS.

Observations, by Mr. W. Snow Harris, on the Statements of Lieut. Green.

Sir,—That Lieut. Green should feel annoyed at having his fallacious statements concerning lightning rods exposed, is very natural; and that he should strongly evince his sense of such annoyance, is also very natural; but, nevertheless, it is not very reasonable; and perhaps your readers might possibly prefer his treating the subject under discussion in a more becoming manner: however, as he appears to have nothing better to offer than personal abuse, and ungenerous misrepresentations of his opponents' statements, we must be contented with it. As far as I am individually concerned, he is quite welcome to the use of such sorry weapons, if he thinks they will at all avail him, or in any way help him out of his present dilemma; the circumstance being to me a very flattering one; for there are some whose praise is censure, and whose censure praise.

I beg to notice a few statements only in Mr. Green's late communication at page 285, No. 221, which I trust may be attentively considered by those who may honour this communication by a perusal, since they immediately determine what a small degree of confidence he is truly entitled to as a writer, and, to use his own words, "as a man of accurate research, LEAVING SCIENCE OUT OF THE QUESTION!" Indeed, I would say, of *no research at all, leaving science out of the question!* I find myself charged with a grossly wilful misrepresentation, in consequence of my reference to his letter, at page 14, No. 204; in which he has arrived at a most unfortunate conclusion, namely, that a thunderstorm in the year 1824 was caused by the erection of conductors in the year 1825. Mr. Green's statements are as follow:—

1st. "A gentleman, NOW (1825) on the continent, writes, that the whole country in the neighbourhood of Lausanne, is undergoing a singular process, called paragrêling," &c.—*Portsmouth Chronicle, June* 18, 1827.

2d. "A terrible storm has devastated the country near Lausanne, in which some lives were lost," &c.—*Plymouth and Devonport Chronicle*, 1824.

Now, because the first letter from the continent in 1825, was alluded to in a paper printed about two years after—that is, in 1827—Mr. Green wishes it to be understood that the latter date is the one he expressly alluded to; to which I reply, so much the worse for Mr. Green's argument. I gave him credit for making the effect precede the cause only by a single year; whereas, and as if the blunder was not already of a sufficient magnitude, he insists upon it that he meant the effect to precede the cause by three years. Beside this, it will be as well to remember, that it is the connexion between a supposed cause and effect which we are seeking to determine, and not the connexion between the *supposed effect* and the *Portsmouth Chronicle*:—indeed, Lieut. Green appears to have some *slight notion* of this himself, for he says (page 14, No. 204) "The first of these extracts shows (that is, in 1825, from a paper in 1827) that conductors were placed as represented, by way of experiment. The second proves (that is, in 1824) that the convulsion of nature was EVIDENTLY caused by these conductors." The conclusion I have drawn from this has been uncivilly termed "a wilful misrepresentation;" at least, Mr. Green "knows not how to characterize it otherwise." Is it so? I appeal, Sir, to your candour, and that of your readers: really, if Mr. Green cannot place so simple a question as this in its true light, what can possibly be expected of him in more important matters. This is a precious specimen of his pretensions to reason upon matters of science, and to report on what he terms the mistaken views of others; not forgetting *the Privy Council, the Royal Society, Dr. Franklin*, and, in short, all who cannot be persuaded to abandon their confidence in the high intellectual powers of those great men, whose talents shed so much splendour on the latter part of the eighteenth century, in order to embrace the unsubstantial and meagre

views (philosophy we cannot call it) of Lieut. Green. Of course, Lord Bacon's principle of induction will next be assailed; for, if Franklin had mistaken views, then, according to the connexion which we are informed is "evident" between the erection of conductors in 1825, and the occurrence of a thunder-storm in 1824, and the *Portsmouth Paper* in 1827, his Lordship's celebrated philosophy, which has so long been the admiration of the world, must necessarily be in very great jeopardy. We are consequently reduced to this conclusion, that if Mr. Green is right, then Lord Bacon has been guilty of writing egregious nonsense;—whereas, if Lord Bacon should, by any *unforeseen chance*, happen to be in the right, then what Mr. Green must have written I leave your readers to determine.

I hope to be allowed the privilege of a further communication on Lieut. Green's letter. I am unwilling to trespass, at present, any longer on the attention of your readers; but I do hope that what he has stated, in reply to me, will be carefully compared with what I have already advanced, and the principles I have endeavoured to illustrate in my preceding remarks, (p. 170, Part. 54): my only reason for making them public was, if possible, to prevent a series of unfair statements from being received as true; that purpose, I have every reason to believe, has been *most fully accomplished*. With respect to what he has subsequently asserted, in relation to myself, it is altogether out of place; *even if it were true*, it proves nothing, if meant as an argument against lightning rods, the subject of discussion. It does, however, prove a great deal, if indicative of Lieut. Green's unfortunate tendency to wander from matters of fact; but this will be again noticed.

W. S. H.

ANCIENT COINS.

Mr. Editor,—Though I have the Numbers of the "Mechanics' Magazine," from their earliest commencement, I do not recollect to have seen any communications on the subject of coins. Amongst your numerous readers, there must, I should think, be some who are fond of the study of ancient coins, and who are versed in the subject. For my own part, I have only very lately entered upon this study, as, perhaps, I shall demonstrate to the more skilful, by the inquiry I am going to make. I shall make it, however, not only for the sake of information on that particular point, but in the hope, by bringing the subject under the notice of your readers, of seeing, from time to time, some communications relative to this interesting study, in your valuable Miscellany.

I have in my possession a penny of Henry the Third's, of his earlier coinage; the double cross being contained within the inner circle, and in each quarter 4 pellets conjoined. It reads on the obverse, HENRICVS REX—the type similar to those of his earlier coinage—and on the reverse,

✠ TER·RIONLVND.

Query—Is not this for TERCI RICARD ON LVND? Ruding mentions, as one of the differences between Henry the Third's earlier coinages and those after his thirty-second year, that the latter have either the numerals III. or TERCI, to distinguish his coins from those of the two first Henrys. I do not find that he gives this on any authentic historical record; but he appears to have deduced it from the coins themselves. This coin may have escaped his notice, or perhaps he has only seen an imperfect one, as I observe he gives TERIRI as one of Henry the Third's moneyers; and were the coin not perfect, the stop after the TER· might be mistaken for part of an I. He also mentions it as an extraordinary circumstance, that neither the author of the "Annals of Waverley," nor Mathew Paris, has made any mention of this distinction between the earlier and later coinages.

Does not this favour the supposition, that TERCI appeared on some of the earlier coins of Henry? It may be observed, the legend sometimes is carried on from the obverse to the reverse, as in the

HENRICVS REX ANG
TERCI LONLIE.

Any information on this subject, generally, may perhaps gratify others

of your readers, as well as your humble servant,

TYRO.

Arlsey, Bedfordshire.

MEASURING A BASE LINE.

In No. 222 of the Mechanics' Magazine, is contained a paper, by Mr. W. Shires, *Mathematical Tutor*, on measuring a base line; in which this gentleman recommends a Gunter's chain to be made of *wood*, instead of metal, because wood, he says, will never alter in length, either by heat or cold, wet or dry.

Now, Sir, I beg to observe, that General Roy commenced his measurement of the base line on Hounslow Heath with deal rods, each of 20 feet in length, and although they were made of the best seasoned timber, perfectly straight, and secured from bending in the most effectual manner, yet the changes in their lengths, occasioned by the variable moisture and dryness of the air, were so great as to take away all confidence in the results deduced from them.

Glass tubes were substituted for deal rods by General Roy, allowances being made for changes in their lengths proportional to the variations of temperature.

Several years afterwards, the same line was re-measured by General Mudge, with a steel chain of 100 feet in length; the result of the measurement by this chain was found not to differ more than 2¾ inches in a distance of 27,404 feet, from the determination of General Roy by means of the glass tubes,—a convincing proof of the accuracy of both measurements.

The expansion of a steel chain of 100 feet in length, subjected to a variation of temperature from the freezing point to summer's heat, is about half an inch, instead of 5 inches, as stated by Mr. Shires; and that of glass tubes, about one-third of an inch only for the same length.

But supposing a line of 16 or 20 miles in length could be measured to half an inch, as your correspondent suggests, there would still be a greater *absurdity* in computing the magnitude of the world, according to his instructions, than in computing the sun's distance from a transit of Venus, as each degree of latitude varies in length; consequently, the result must be erroneous, unless the earth's compression is included in the computation. In respect to the *sun's distance*, I would advise Mr. S. to consider the subject more attentively, before he ridicules what he does not appear to understand. Surely Mr. Shires knows, or at least ought to know, that *correct* results are very frequently obtained from those which, in the first instance, are only *assumed* to be such.

J. UTTING.

Lynn, Dec. 1827.

VENT TO BEER CASKS, &c.

Many have been the plans proposed for letting air into casks to occupy the space of the fluid drawn out; without which admission, of course, the air contained in the cask will become rarer than the external atmosphere, and occasion a tendency in the fluid to *recede* rather than *proceed*.

Perhaps my plan will be despised by the *mere drinkers* for its simplicity; but I think not by the *real tapsters*.

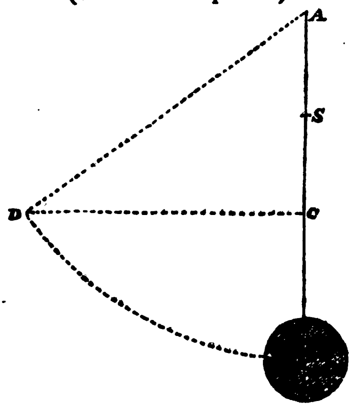
All I find necessary to obtain every advantage of the many-boasted "*only safe and sure vent-taps, plugs, valves*," &c., is to insert a *common beer-cock* into the tap-hole immediately under the *head* of the cask; and thus I can let *air in* while I draw *beer out*, and securely prevent any escape of the internal gas, by properly turning the cock, when sufficient is admitted. I have some thoughts of connecting this cock to a reservoir of carbonic acid gas, and thus atmospheric air need never be let in on the top of the beer; but I am not satisfied but that a small portion of oxygen gas is beneficial rather than otherwise; for we know, in London, that fermentation is slowly going on for months, even while the beer IS IN DRAUGHT, and, probably, some oxygen is necessary. It is a common remark, that beer generally improves "*by drawing*."

Query.—Whether this does not arise from the admission of oxygen in small portions?

$\frac{10}{26} + \frac{13}{26}$.

ANSWER TO THE QUESTION IN MECHANICS.

(See Vol. viii. p. 136.)



Sir,—I beg to hand you a solution of the "Question in Mechanics," No. 212, page 136.

Let A B equal the length of the pendulum, and D B the arc of oscillation; then, by the nature of the question, the arc D B, in an angle of 57° 18′, and the complement of the angle C D A, =32° 42′. Then, as sec. ang. D : A D :: tan. ang. D : A C, =32·4 inches, A B—A C= C B=27·6 inches, the versed sine of the arc. Hence, the weight B : B D :: C B : the power that is required to move the weight on the arc D B. 60 in. : 16 oz. :: 27·6 in. : 7·3 oz., the power required at B. Since the power is to be applied at S, the pendulum is a lever of the third order.

A S : 7·3 oz. :: S B : 41·36 oz. = 2lbs. $9\frac{36}{100}$ oz., the power sought.

I am, &c.

W. TONKIN,

Mine Agent, Wheal Howell, by Fowey.

FIRE-ENGINE FOR STEAM-BOATS.

Sir,—Accidents from fire are at all times dreadful, but more particularly so when they happen on board a crowded vessel at sea, from the difficulty the crew and passengers experience in making their escape from the conflagration, when they find their feeble efforts to extinguish it unavailing.

Every method, therefore, which is at all likely to afford relief in such cases, is deserving of our most serious attention. Several methods have, from time to time, been proposed for extinguishing fire in ships; and large vessels are, in general, provided with apparatus for that purpose: but our newspapers have lately recorded the loss of several *steam-boats* by fire, and it is for the preservation of this class of vessels that I throw out the following suggestion:—

Let every steam-vessel be provided with three small forcing-pumps, placed at the side of the vessel, near the main axis of the steam-engine; to which the three-throw crank working them is to be connected by what is termed coupling or gearing; the pumps to draw their supply through a metal suction, or feed-pipe, let into the bottom of the vessel, and furnished with a drain. The three pumps to work into an air-vessel, from which two tubes should proceed, fore and aft, furnished with screws and caps.

In case of fire, let the cap nearest the scene of danger be taken off, and a hose and branch attached; let the pumps be thrown into gear, and a most efficient and overpowering stream of water would be immediately brought to bear on the devouring flames, without any bodily exertion on the part of the crew.

Indeed, a vessel so provided would be almost invincible to the destructive element of fire.

I remain,

Yours respectfully,

WM. BADDELEY, JUN.

10, *George-yard, Lombard-street, Nov.* 26, 1827.

INQUIRIES

Which we have been requested to submit to our Correspondents.

For the best cement for uniting polished surfaces, such as ivory, or the harder kinds of wood. The "Manuel du Tourneur," p. 216,

prescribes one composed of common glue and honey, as directed. But proportions are not there given.—By "L. of Chester."

For the preparation necessary to make wood float on oil—The inquirer has tried various kinds of wood, both solid and hollowed; and have coated them with paint, and different sorts of varnish: but, in a short time, the wood has become saturated with oil, and sunk to the bottom of the vessel.—By "L."

For the ingredients of the most effectual composition for preserving illustrations of natural history; also the manner of skinning animals and birds; and information whether it is, at all times, necessary to remove the contents of the skull of the latter.—By "J. C. H., of Dartford."

For the method of staining American birch and beech in imitation of rose wood and mahogany; and also a receipt for polishing mahogany light. A particular description of the process will much oblige many who daily use it, as well as the inquirer, "J. B."

For any dry composition that will mark on *glass*. It is wanted for the purpose of sketching the outlines of figures for the magic lanthorn. Also, what are the best colours to be used in painting the glasses; and the best varnish with which to work up the colours. The inquirer wishes also to know, if the *Fantasmagoria* may be exhibited by the common magic lanthorn, and how?—By "A Subscriber."

For the best mode of extinguishing a fire under the following circumstances:—

I have got a large building roofed with timber, and from peculiarities, which are unnecessary to name, I am apprehensive of fire. Now, in most cases of fire, a timely application of water would arrest its progress, and property to an immense amount would be saved. Immediately adjoining my concern there is an abundant supply of water; but the buildings are high, and consequently the difficulty of applying water to the roof is great. A fire-engine is too expensive; but something in the nature of a pump—a moveable one perhaps—may answer the purpose intended. Some time since, I read, in your interesting Publication, a description of Eves's rotary pump, but latterly I have not read any thing further on the subject. If some of your numerous readers could afford information on this subject (adding the prices), it may generally inform your numerous readers, and it would particularly oblige

Your obedient Servant,

A CONSTANT READER.

N. B. If the expense were not too great, I should like two pumps.

DAMP HOUSES.

Sir,—I have lately taken a house here, and admire the situation, but unfortunately I find the place is much subjected to damps. The walls of my residence seem perfectly dry, though the cupboards and closets are so far from being so, that every thing is spoiled that is put into them. The shoes that I wear on Monday, I cannot put on on Wednesday, without first putting them to the fire for two or three hours. If any of your correspondents will mention an economical remedy for this, if possible—if not, then the best way to guard against the ill effects of it, they will much oblige a subscriber to your Magazine from the beginning.

J. P. H.

P. S. The house is built upon a bed of gravel of seven or eight feet deep.

Bayswater, Nov. 19, 1827.

AEROSTATIC PHENOMENON.

Sir,—To illustrate a lecture on pneumatics, which I delivered to my pupils in the summer, I procured a Turkey-crop balloon, which, when filled, I suffered to ascend to the height of 100 yards, secured by a thin thread. When at that height, I observed what appeared to me a singular phenomenon. Around the balloon was an undulating atmosphere, exactly similar to that which is observed about a stove, occasioned by the rarefaction of the air. I at first supposed it was owing to the escape of the gas, but on lower-

ing the balloon, did not discover that to be the case. An explanation of the above, by any of your correspondents, will much oblige,

Sir, your obedient Servant,

T. P. LOVELL.

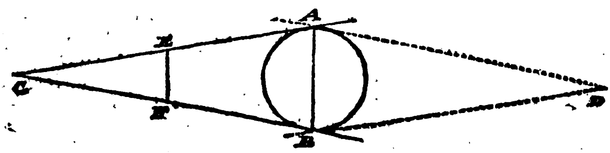
Academy, Olney, Bucks,
Dec. 3, 1827.

WRITING IN THE DARK.

Sir,—In No. 215, page 192, is an extracted article from a contemporary Journal, offering an ingenious plan for invalids and studious persons, when in bed, to write down any idea which may occur to them. But the slate which is there recommended to be used is, I think, objectionable, inasmuch as the moving of the sheet, and consequent rubbing, may, perchance, efface the bright ideas inscribed thereon, and thus cause an irreparable loss, not only to the man of letters, but to the world at large. I would recommend, as far preferable, the following mode; for, having myself been lately laid up for some time, I can, unfortunately, bear testimony to its superiority:—Get a slate-frame made with a moveable top, grooved, to receive a sheet of Bath card, and then rule it similarly to the one described in your Magazine—a Mordan's pencil is preferable to the cedar ones, as they do not require cutting. The writing may be rubbed off with Indian rubber, and the card be thus made serviceable for several times; otherwise, it would prove an expensive plan. As every improvement, however trifling, contributes, in some way or other, to the comfort and happiness of society in general, I have been induced to lay this before you, in the hope that it may be found worthy a place in the Mechanics' Magazine.

I am, Sir,
Your obedient Servant,
AN INVALID.

ON FINDING THE DIAMETER OF A ROUND STEEPLE.



Sir,—Mr. Shires gave us lately a method of finding the diameter of a round steeple. The following may not, perhaps, be so simple, but it appears to me a more practicable method. Your insertion of it will much oblige,

Sir, yours, &c.
J. O. B.

Let A B be the diameter sought. At equal distances from the building, in a straight line, place two objects, C and D, (this may be done by the aid of a pocket compass); from the point C, in a direction with the wall of the tower, measure the lines C A, C B, till in a line with the wall of the tower and the point D; in other words, till intersected by the imaginary lines D A, D B. The diameter, if extended, would cut the points of intersection. Noting the distance of intersection from the wall, measure back half the length of the lines A C, A B, twice the distance from E to F, the distance of intersection from the wall deducted, will be the diameter by 34th prop. 1st book of Euclid—"If two sides of a triangle be bisected, the right line joining the points of bisection, will be parallel to the base, and equal to one half of its base."

NOTICES TO CORRESPONDENTS.

The Report of the London Mechanics' Institution in our next.

Communications received from Mr. Dubois—F.—C. M. W.—Mr. Hingston—J. S.—An Occasional Reader—W. James—B. K. S.—J. Alwin—K. B. G.—A Brewer—P. H. D.

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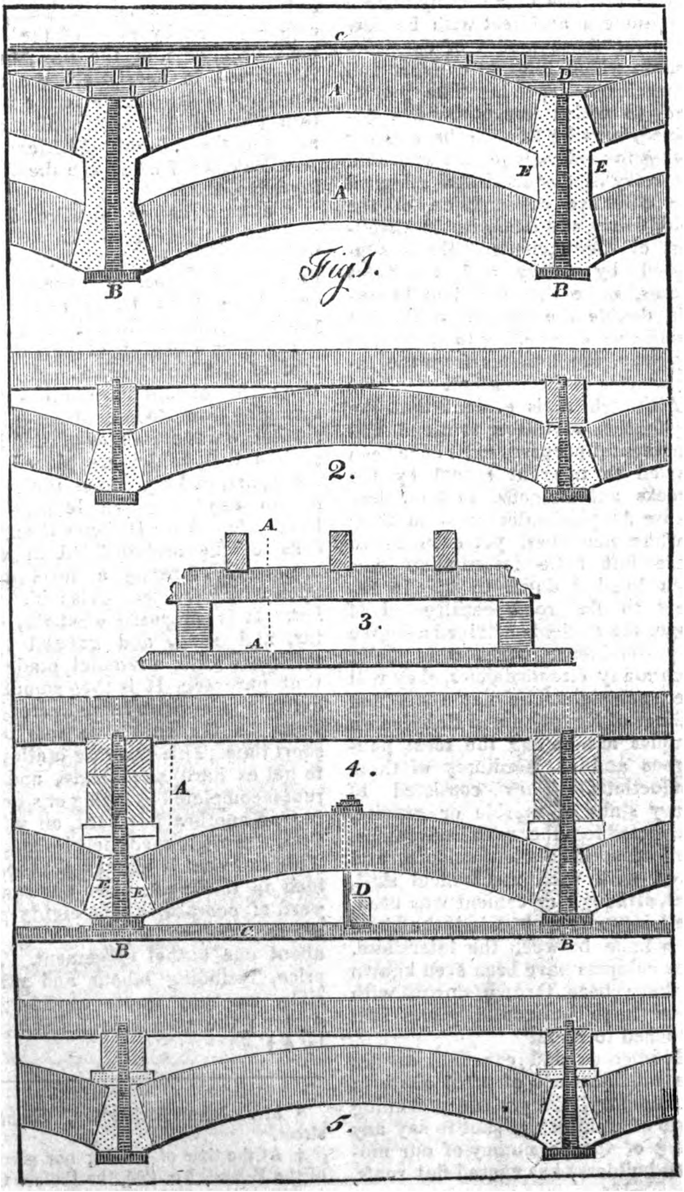
No. 226.] SATURDAY, DECEMBER 22, 1827. [Price 3*d*.

ROOF AND FLOORS OF THE NEW PALACE.



ON THE CONSTRUCTION OF THE ROOF AND FLOORS OF THE NEW PALACE, ST. JAMES'S PARK.

By Mr. Christopher Davy, Architect and Teacher of Architecture.

The remains of antiquity furnish the modern architect with but few hints for those modes of construction on which internal comfort and convenience depend. The perfection to which carpentry has attained, may be said to be entirely owing to modern ingenuity and skill. Tapestry ill disguised and screened the defective construction of the cold, damp, and inhospitable, dwellings of the ancients. Roofs supported by heavy and cumbrous beams, more than sufficient to sustain double the weight, could not even boast of a ceiling to shelter, in any way, the inmates from the inclemencies of the weather.

Although it is evident that the application of timber to useful and ornamental purposes must have been carried to a great extent by the Greeks and Romans, in their immense Amphitheatres, and in their warlike machines, yet even as to these but little information has been handed down to us. In respect to flat roofs constructed of stone, the ancients attained a degree of pre-eminence, which it is likely, from many circumstances, they will ever possess. The flat roofs and ceilings of Egyptian and Babylonian temples are among the most ponderous and extraordinary of these productions. They consisted of heavy slabs of marble or granite, connected together with iron cramps, worked so exquisitely smooth, and fitted with such mechanical skill, that, although no cement was used, the joints would not admit the blade of a knife between the interstices. The columns have been even known to have been thrown down, with these huge horizontal pieces still attached to them.

Numerous and excellent as are the modifications of *pitch roofs* in this country, the present prevailing style of architecture (not to say any thing of the parsimony of our modern builders) has caused flat roofs, and suitable coverings for the same, to become great desiderata. Without swelling this article into a review of the many *notable* designs for this purpose, I shall proceed at once to describe a plan which has at least the recommendation of being countenanced by most of the eminent architects of the day; being introduced in nearly all the new buildings of magnitude in the western part of the metropolis, and, amongst the rest, our *old* friend the *New* Palace (of which see the drawings, No. 205).

We have before mentioned the eminent builder * to whom the public are mainly indebted for the general introduction of coombs (invented between thirty and forty years ago), for roofing, flooring, &c.

Fig. 1 is a section of part of the roof of the New Palace. A A are two arches of coombs or hollow pots, springing from stone abutments E E, resting on the flanges of the iron girders B B, which are placed five feet apart, and lay across the building to any proposed length—say twenty-four feet; D shows the spandrils of the arches filled in with brickwork, forming a level roof, upon which the cement is laid, *quite hot*. It is composed of chalk, coal tar, and sand, and gauged to a thickness with a templet made for that purpose. It is then smoothed out to a level, with large heated flat irons, as the substance sets in a short time. This covering is allowed to get as hard as possible, and the roof is completed by laying or spreading on another hot coat, on which the slates are immediately imbedded. This last coat is about 5-8ths of an inch in thickness. For one square yard of coombs, about eighty pots are required, which, in setting, use about one bushel of cement. The price, including labour and materials, we may quote at 15s. per square; the pots measure 6 inches by 4.†

* Mr. John Richardson, Spencer-street.

† At the time of writing our account of the Palace, No. 205, the Picture Gal-

Figs. 2, 4, and 5, represent the different methods of fixing joists for the flooring above the coombs for intermediate stories. Fig. 4 further shows a bolt passing through the centre of the arch, and clipping a trimmer joist D, to which the ceiling joist C is fixed, ready to receive lath plastering.

Fig. 3 is a section of A A, fig. 4.

It is not necessary, in *common rooms*, that joists should be laid across the coombs; they may be covered with *cement instead of flooring*, as is the case in his Majesty's new Mews at Pimlico.* Of the proportions for the composition with which this roof is covered, we regret that we are not able to furnish as satisfactory particulars as we could have wished; but the following extract from a Norwich paper, about five years ago, will at least give some valuable information as to the use of a composition *similar* to that used at the Palace; but in this *lime is used*—at the Palace, *chalk*.†

" *Economical Use of Coal-Tar.*

" It perhaps may not be generally known to farmers and others, that coal-tar, which can be obtained at any gas manufactory for a mere trifle, may, without much trouble, be converted into a most valuable pigment, preferable, in many instances, to oil-paint, for the preservation of gates, doors, hurdles, or any other description of wood or iron work that has to be exposed to the action of the weather. Timber properly coated with this substance has been found most effectually to resist the depredations of all descriptions of insects, which often cause its rapid destruction. The method of using the coal-tar is as follows:—Take a quantity of lime from the kiln, and having added to it a sufficient supply of water to make it fall into powder, pass it through a sieve, to take from it stones, or any unburnt pieces; then take a quantity of the coal-tar, and mix it well with some of the powdered lime, and apply the mixture in the same manner as common paint, taking care it be well stirred during the time of its application, to prevent the lime from settling to the bottom of the vessel. The quantity of lime may be varied, to produce a proper body; and to suit the time in which it is required to be set, an increased quantity will cause it to become hard sooner, and of course improve its substance; but, in general, a pint of the powdered lime will be found sufficient for a gallon of tar. It ought, perhaps, to be here observed, that too great a quantity should not be mixed at once, as in a few hours it is apt to become thick, and is then not so good to work. When it is wanted for ornamental purposes, as well as utility, several colours may be formed in a very cheap and simple manner: for instance, an invisible green may be produced by mixing powdered yellow ochre with the lime and tar; and chocolate colour, by Spanish brown."

The concluding part of this account may, at any rate, be of some service to " *One of your First Subscribers*," as it bears a great similarity to the composition used in the Palace; but as to its durability, *without the slating*, I am very sceptical, and think the latter a wise precaution.

" A most excellent roof for country cottages, &c., may be made by applying two or three coats of the tar and lime on common thatch, and then throwing on the last coat, while wet, dry sand; which forms a compact hard mass, impervious to water. For *out-houses and small buildings*, dip sheets of strong brown paper in *boiling* coal-tar, and nailing them on thin boards or lath, in the same manner as slates, the whole is then to be painted over with the tar and lime, and then sanded. As the roof will not need to rise more than two inches to a foot, the timber required will be much smaller than for any description of roof."

C. Davy.

lery *only* was slated; the roof is *now* entirely slated over.

* Erected by Messrs. Richardson and Co.

† In the account of the Palace (No. 205), *lime* was mentioned by mistake.

ON TAR ROOFS.

Sir,—"*One of your First Subscribers*" wishes to know the composition used for the New Palace, in which the slates are imbedded; and mentions that it consists of hot tar, lime, and sand. I cannot tell him any thing about the roof of the New Palace; but I can tell him how to construct a tar roof in, I will venture to say, a better and cheaper manner than I have yet seen published. To the accuracy of the details I pledge myself, and to its having the properties of cheapness and durability. Having, about seven years since, occasion to construct a horizontal roof, I bethought myself of trying a new plan for a tar roof, which has ever since been entirely water-proof. The method I propose is as follows:—

Let your joists be so slight, as to be merely sufficient to bear a person's weight upon them: over these nail a set of boards grooved, and fitting into each other like a floor; these, also, need be no thicker than to support a person's weight on them. When you have thus boarded or floored your roof, get a quantity of coarse brown or wrapping paper, and cut it into strips of about two inches broad: then take a quantity of coal-tar paint, or simply coal-tar boiled with a little new slaked lime. With a brush do over the joints of your boards with the coal-tar, and on this lay your strips of paper along all the length of your joints; and lastly, do over the paper with a coating of the coal-tar. Next get a caldron as large as you can find, provide yourself with a barrel of coal-tar,* a quantity of river or sea sand, and a quantity of new slaked lime *quite dry*. Light a fire under your caldron, and pour into it a portion of tar. Take next a *riddle*, or coarse sieve, and as your tar heats, riddle into it about equal proportions of lime and sand, continuing to stir it constantly till it comes to boil. Let the mixture, when boiling and ready to be used, be as thick, as that it can be spread out *while hot*, but will be perfectly solid at about 130 degs. Next, provide yourself with two or more flat instruments like tailors' geese, with long wooden handles, and heat them almost red-hot.* When you have made your tar *thick enough*, and brought it to the boiling point, put a quantity of it into a small iron pot, with which and one of your heated irons mount on the roof. Pour out a quantity of the boiling tar on the roof, and spread it flat with the hot iron to about the thickness of a quarter of an inch, or rather more; and continue this till you have gone over the whole roof. N.B. You cannot make your tar too thick, provided only you can spread it by the hot iron. The advantages of constructing a roof thus are the following:—

1. It will continue water-proof for years, which the common tar roof will not; as the latter soon allows the water in some little point to penetrate the tar, till it comes in contact with the pasteboard over which the tar is spread, which swells, and becomes very soon no longer water-proof.

2. It is much cheaper than any other; for it need be no stronger than to support a man's weight on it: thus you save a deal of wood-work, and besides get rid of the enormous expense of the pasteboard which in general is used, and which requires to be renewed every seven years at farthest; whereas this roof will never require any other repair than a new coating of tar, when the old is worn out, which, if coal-tar be used, will happen but very seldom.

3. It may be constructed either horizontal or sloping, as suits the convenience of the person making it.

4. It is so simple, that any one who chooses to superintend the work himself, has no need of employing men skilled in the business, and who charge proportionately high for their services; but may

* I recommend coal-tar, as much superior to common wood-tar as to durability; but where it cannot be had, the other may be used.

* As hot as to melt the tar readily, but not so hot as to set it on fire.

employ any labourer at it, and be sure of having it as well executed as if he had employed the first plumber and slater in London.

The roofing of the New Palace, if I understand what is said of it, is very liable to go wrong, as I cannot see how they are to repair it when it gets out of order, without taking up all the slates. In conclusion, the roof I recommend has been tried and found to answer, and is of far less expense than any other; and I therefore recommend it to your readers' attention.

I am, Sir,
Your's sincerely,
FRANCOIS DUBOIS.

Dec. 8*th*, 1827.

MR. JOPLING'S SEPTENARY SYSTEM.

Sir,—Reflecting on what you have so ably stated in reply to Mr. Seers, from the information you were in possession of, I can scarcely imagine what would have been your feelings or language, had you known the whole of the history of my endeavours to make known the Septenary System.

I have not, it is true (as you justly observe), in consequence of the certainty of great expenses, proceeded so rapidly or so extensively either in publishing illustrations or descriptions of the various instruments by which the principles may be carried into operation.

But my mind has certainly been, on every leisure moment, almost incessantly engaged on the subject during the last six years. No gentleman to whom the subject was interesting, ever called upon me without seeing the apparatus, and specimens of the curves, and receiving a general explanation.

I have reason to suppose that many persons have been deterred from even almost thinking on the subject, from an idea that an extensive knowledge of the higher branches of mathematics is essential to understand or apply any of the principles. But this is not the case, although it certainly requires either considerable study, instruction, or illustration, by numerous examples, in order to have a comprehensive knowledge of the whole. With instruments, this knowledge may be obtained by practice.

Notwithstanding the many thousand impressions which have been circulated, of the united Testimonial of Dr. Olinthus Gregory, Mr. Christie, Mr. Aikin, Mr. Tredgold, and Mr. Peter Barlow, of the originality and great utility of the first apparatus for generating curves in several divisions of the system, *I have never sold one.* I was favoured with the Testimonial in August, 1823.*

Every person is aware, that all new attempts of mechanical construction are attended with greater expenses than subsequent operations of the same kind, when the principles have become familiar; and the general disposition of both private individuals and public institutions is to wait until things become cheaper.

Finding that instruments embracing the whole, or the principles of a number of the divisions, were not likely to be sold at the prices for which a few could be manufactured, I was induced to try the publication of instruments for the First Division separately.

There are now, of the instrument called "Double Cranks," with a classification of the motions of the First Division, between eighty and ninety in the

* "We, the undersigned, have seen Mr. Joseph Jopling's newly-invented apparatus for the organical description of curved lines, and have also seen its mode of operation, and have inspected a great variety of curves which have been described by means of it. We have no hesitation in saying, that we regard this apparatus as most simple and ingenious—capable of producing, with the utmost facility, *an indefinite variety of curves;* comprehending those which have been the subject of mathematical research, and numerous others which cannot fail to be of great utility in naval architecture, in the ornamental departments of civil architecture, and in the formation of patterns in the imaginative regions of the arts. To mathematicians the use of this apparatus will suggest a variety of inquiries in reference to new and curious curves whose properties have not as yet been investigated; while to architects, shipwrights, engravers, and many others, it will be found subservient to the most fertile and interesting applications.

(Signed) "OLINTHUS GREGORY, L.L.D.
Professor of Mathematics,
Royal Military Academy.
"S. H. CHRISTIE, M.A.
Of the Royal Military Academy.
"ARTHUR AIKIN,
Secretary to the Society of Arts.
"THOMAS TREDGOLD,
Civil Engineer.
"PETER BARLOW, F.R.S.
"*August*, 1823."

hands of subscribers; and I hope to have an opportunity of publishing a list of the names of those gentlemen who have patronized my attempts.

A register, and specimens of the curves in this Division, which I was fearful to undertake in the first instance (both from the time and the expense that would be necessary), are still wanting to complete my ideas of the method of illustration.

It would, indeed, require at least a thousand examples to illustrate adequately the effects of the several cases of motion in the First Division; although every adjustment for any one example, in a variety of ten hundred thousand (to mention a definite number), may be made with equal facility.

A proper arrangement of the numerous examples would be little, if at all, less difficult, than the compilation of the several propositions in the Books of Euclid; and it will be necessary, to ensure perfect accuracy, first to teach the engraver, before he can proceed with such a work.

A nomenclature of the specific motions, and their various effects, would be desirable; so that, from the name of an instrument, the character of the lines it would describe should be known; or, speaking of a line, to know the instrument and adjustment by which it can be generated.

Since the discovery of the Septenary System, I have been visited by several Professors from different Universities on the Continent, and most of these have purchased the "Double Cranks;" but I have been only favoured by a call of one Professor from Oxford, who intimated, that there they had no funds available for such purposes; and I was honoured with a letter from another at Cambridge (to whom I had sent my first Pamphlet on this subject), in which he stated that it was quite out of his line of reading at that time.

I have shown my different instruments, and specimens of their productions, publicly, on several occasions:—

By the kindness of Mr. Davies Gilbert and Mr. Hume, to a Committee in the House of Commons—at the Institution of Civil Engineers, by the introduction of my friend Mr. Tredgold, where, in consequence of my inventions, I was elected an Associate—at the London Mechanics' Institution, by the kindness of Dr. Birkbeck—at the Royal Institution, by Mr. Farraday—at the Mathematical Society, and also at the Astronomical Society, by Mr. Gompertz—and through the politeness of Sir H. Davy (the late President) at the Royal Society. To most of the above—to the Navy Board—to the Royal Society of Scotland—to the Society of Arts—and to various other Institutions and distinguished individuals—I have either presented the pamphlet, or specimens of the curves; and, in several instances, both have been given.

At page 9 in the pamphlet, which I published in April, 1823, I alluded to the evident utility of the application of the principles of the Fifth Division to naval architecture. And I there anticipated the difficulty, from the little experience I had then had, of establishing a new principle in ship-building; at the same time I pointed out that I considered the most obvious method would be the introduction of a knowledge of the principles into the naval schools in this country.

In February, previous to the publication of the pamphlet, and (it may be proper here to say) also before the construction of any instruments, I attended by the appointment of the Navy Board at Deptford, to explain to the practical officers of that Yard the principles of my method of generating a series of intermediate sections between two selected forms for midship and bow sections.

The appointment was made in consequence of the inclosed statement, which was sent to the Navy Board in November, 1822.

I understood at the time, from the officers of the Deptford Yard, that they considered *that without an instrument they could not sufficiently judge of its utility*; that it was due to me, that they should recommend the Board to direct one to be made: they admitted that the principle was new—that they had no idea that such curves could be generated—could perceive that it was capable of making the changes required in the example given—and *thought it might be useful in getting out their moulds.*

It may be proper here to state that, by the order of the Navy Board, two of the students in naval architecture were present at the time.

After this meeting, I received a letter from the Navy Board, stating, that from the report which they had received from Deptford, my plan of producing curves, although ingenious, was not likely to be useful in naval architecture.

In April following, I published the pamphlet, a copy of which, at the time of publication, I presented to the Navy Board.

I next constructed an instrument,

which obtained the united testimonial already alluded to in August, 1823; and in consequence of a copy and invitation being sent to the Navy Board, they sent three gentlemen to see it.

April 30th, 1824, I sent specimens of curves to the Navy Board.

December 7th, 1824. In answer to an offer to communicate to the students in naval architecture a knowledge of the principle, and applications of the system, which I had at this time classified, I received a letter from the Navy Board stating that they had had my system of generating curves under consideration, and that it appeared to them not adapted to the construction of the draught of a ship.

I replied to this letter, by stating that I had no doubt but that such was their opinion; but so clear was my own conviction, that *a familiar acquaintance with the principles*, the regular gradations (which might be effected in a variety of ways in a perfect manner), together with the *modes of application*, would be useful to both naval architects and ship-builders; that I ardently entreated they would have the kindness to appoint *some one, at least*, to whom I might communicate a thorough knowledge of the system.

In February, 1825, the Navy Board again had the goodness to take the matter into consideration, and appointed five of *the students in naval architecture* to examine into the system and to report thereon; and I understood that not one of them was acquainted with the previous decisions; but I afterwards found that two of them had been at Deptford, when I attended there two years before.

These five students attended me five days, and I was about three weeks altogether employed at that time (including the five days) in preparing examples and writing observations for them on the application of the *Fifth Division*.

After their attendance, these young gentlemen stated, as their opinion, that, according to the present system of constructing ships, they do not think the instrument holds out sufficient advantages to induce their recommending its introduction: at the same time, *that, as a speculative research, they think it might lead to the developement of principles in some way useful to the naval architect; and conclude by saying that they were not unanimous in their decision.*

The Navy Board now informed me, that, having had under their consideration my proposal and further explanation of my system, as applicable to preparing plans for building ships, and having consulted such *authorities* as they considered proper on the occasion, they find it difficult to come to any other conclusive result on the subject than that which had already been communicated to me. They admit that my plan was ingenious, but, with regard to its applicability to the plans and draughts of ships, they can by no means allow that it possesses any advantages which may render it expedient to introduce it in the *King's service*; upon the whole, therefore, they decline my offer.

Considering that the instrument which I had exhibited to the students, and which was for the general explanation of the system, might make the application appear too complicated, I constructed a temporary instrument on the principles of the *Fifth Division* only, and sent it to the Navy Board, having previously instructed a child of seven years old to draw lines with it.

One of the Surveyors of the Navy, at this time, like the practical officers at the commencement of the correspondence, said *that it would or it might be useful in getting out their moulds.*

This instrument, and the examples I had prepared for the students, were returned to me in June, 1825; since which time I have had no correspondence with the Navy Board: however, in concluding this statement, it may be proper that I should say, that the expenses paid to the students on the latter occasion by the Navy Board, were about 40*l.*; but that I never have received one farthing from them, nor have they, or any person connected with them, purchased an instrument of any description from me.

Some months ago a private ship-builder ordered an instrument on the principle of the Fifth Division; but from business, and a variety of other circumstances which it is not necessary here to explain, it is not yet quite finished.

Specimens of lines produced by a working model of the instrument were presented last session to the Institution of Civil Engineers.

Knowing that I have not met with greater difficulties than (to mention no others) those who so frequently attempted and so frequently failed to introduce steam and gas; and as I am fully convinced that (as has been stated to me by a friend) sooner or later my system of curves will be introduced in schools for naval architecture; it is my determina-

tion, whenever I have leisure and an opportunity, to continue urging its introduction into the Naval College: and certainly a knowledge of the methods of generating the very forms they aim at, must be as likely to be beneficial to them as the study of any other branch of mathematical science, and cannot possibly do them any harm. Indeed, I have reason to suppose that the parabola and hyperbola will be found amongst the numerous lines of the Fifth Division, which also produces the chonchoids and cissoids.

Much more might be said on the several parts of the foregoing communication, and on several other endeavours not alluded to; but, probably, I have now stated sufficient to prove to Mr. Seers and your readers that I have sought for an opportunity, and, had any thing like a prospect of the most reasonable kind occurred, I should not have failed ere now to have published the whole.

I am, Sir,
Your obedient Servant,
Jos. Jopling.

P. S. As I shall reply to Mr. Alderson, it is not necessary for me now to take notice of any other part of Mr. Seer's letter. Mr. Desvignes' letter, which I have not yet seen, I shall also attend to in its turn.

STATEMENT SENT BY MR. JOPLING TO THE NAVY BOARD, NOV. 1822.

"*Statement of a few of the applications and advantages of a new and accurate principle of describing curves for ships.*

"First. A curve line may be described by continued motion, that shall resemble the curve of the midship frame, from the top to the keel, of any of the several forms on which that frame is generally constructed.

"Second. The forms of the curves, as they are generally drawn for the stern and loof-frames, may also be described by continued motion.

"Third. And having determined on the form of the curve for the midship, stern, and loof-frames, the form of the curve for any other frame, situate any way between the midship and stern, or between the midship and loof-frames, may also be described by continued motion. Each of the intermediate frames will partake most of the form of that frame to which it is the nearest, whether it be to the midship, stern, or loof-frames.

"Fourth. The principle of generating such curves is equally applicable to the making of a small drawing, and to the describing at full size the midship-frame of a vessel of the greatest magnitude.

"Fifth. The nature of each curve will be known by the mode of generating it; and, whether it be required to ascertain the capacity of a vessel, or the best form for sailing or for strength, a knowledge of the curves must be useful.

Sixth. The forms of the frames drawn drawn by continued motion to resemble those required, will, nevertheless, be different to those curves drawn in the usual way; as a curve, formed by putting together sweeps of different circles, must have indents or elbows where the different sweeps meet; whereas a varying curve, drawn by continued motion, has a constant and imperceptible change.

"Seventh. The several frames of a ship being thus formed, every water-line will be a fair curve; and that labour and difficulty of adjusting the curves, which is admitted to be considerable, will be avoided."

Joseph Jopling.

24, *Somerset-street, Portman-square, Nov.* 21, 1822.

REPLY OF MR. DESVIGNES TO MR. JOPLING.

Sir,—With unfeigned surprise I perceived (two days since) in your highly valuable Magazine (vol. viii. No. 220, p. 202), a paragraph by Mr. Jopling, wherein he strives to bias the minds of the public, as regards the originality of an instrument which, he says, I "call a Speiragraph."* Since it is impossible to judge until both sides of the case be heard, perhaps you will favour me by inserting the following statements, to which I have also subjoined a few remarks, &c. on Helicosophy. †

Mr. Jopling I never saw more than twice. He came (as a stranger) with

* This term is formed of σπεῖρα and γράφω, to which, as a Greek, I had recourse, both from natural feelings of the highest respect which I consider due to my native country, and from observing that the English and French also derive their scientific words from Greek. Speiralinead, for euphony sake, might likewise have been adopted.

† "The art of delineating spiral lines on a plane."—*Ency. Londinensis.*

his double cranks, to request I would subscribe;* he also begged of me to "favour" him with a "call," which I did, to oblige: he then hinted that the "spiral might be formed by the inverted trammel," and explained what he "calls the septenary system" (of which more hereafter). Though I objected to the "double cranks," in the state I then saw them, nevertheless I took one, by way of encouragement.

If Mr. Jopling means to assert that he showed or described to me any one other apparatus or method for delineating spirals (than the two just mentioned)— if such, I say, be his meaning, I must pronounce it to be an unpardonable deviation from truth.

My friend, J. B. Watson, Esq., a subscriber to my Speiragraph, who has also seen Mr. Jopling's "instrument for describing volutes," has informed me that they differ both in principle and construction.

The merits both of Mr. Jopling's Septenary System and of my Speiragraph will, probably, be better understood by a brief summary of what has been previously done in regard to generating of lines by continuous motion. Your readers will then be able to judge "to whom the credit of originality in this instance belongs" (to use Mr. Jopling's own words). However, I will first quote one of the poets:—

"Man's chiefest danger lays in doing well;
No crime so great as daring to excel."

1st. "Suardi's Geometrical Pen,"† by a circular and continued motion, will describe right lines, triangles, circles, ellipses, cycloids, epicycloids, spirals, "infinite cuspidated lines," "nodated lines," &c. &c. variable *ad infinitum.* This pen, whose curious properties will exercise the ingenuity of mechanics and mathematicians, is little known in this country. The inventor enumerates 1273 distinct curves as possible to be described by it, in the simple form, which is variable to a most astonishing extent.

2d. A clever mechanic* (about twenty-five years ago), contrived a rose-engine, by which may be generated infinite varieties of curves by continued motion; viz. right lines, triangular, circular, elliptical, cycloids, epicycloids, &c. I have by me several beautiful specimens effected by this machine. In fact, its properties include the "Septenary System," and considerably more. In the former, the plane moves vertically—in the latter, horizontally.

3d. An instrument published thirty years ago, by Adams; of this Mr. Jopling's (in all appearance) is a fac-simile: the principles of both run thus:—"The motion of a plane in contact with another plane at rest, regulated by poles, right lines, &c."—(word for word).

A knowledge of the three above-mentioned principles (chosen from several others which might have been named), will, I think, suffice to make a due discrimination between the original and the copy, in this particular "instance."

The four divisions, comprising a few of the principles which I used in helicosophy, I have arranged as follows, viz.:—

The tendency of a point directed and generated by the rotation
of a right line, constitutes the 1st division;
—a plane, constitutes the 2d division;
—circular lines (as wheels), constitutes the 3d division;
—two right lines (intersecting), constitutes the 4th division.

[We are obliged, through the accidental want of some necessary wood-cuts, to defer the remainder of Mr. Desvignes' letter till our next. Meanwhile, we would again recommend to our readers to form no judgment on the matters in dispute, till all parties have had a full hearing. When men of such extensive knowledge as Dr. Gregory, Mr. Barlow, Mr. Aikin, &c. have certified, in such strong terms, the originality and value of Mr. Jopling's discoveries, it should induce one to be slow in believing any thing to their prejudice. Neither is it reasonable to suppose that Mr. Jopling himself can have paid so little attention to the history of his favourite pursuit, as not to know well both what Suardi effected, and what Adams has published. It is

* Perhaps this may also bring to his recollection a drawing which I showed him (consisting chiefly of spirals) that I had that very day completed.

† This clever and curious instrument was invented and described by John Baptist Suardi, in an interesting work entitled, "*Nuovo Instrumenti per la Descrizzione di diverse Curve Antichi e Moderne,*" &c. Italy.

* I do not at present remember the name and residence of this ingenious man; but I can easily ascertain: he constructed a rose-engine for my father, which has been in my possession several years; likewise a lathe, &c. &c.

worth keeping in mind, also, how common it is to find that men of genius, who have been engaged in similar speculations, have been led to similar discoveries, without the least knowledge of each other's success.—EDITOR.]

ON THE MANUFACTURE OF FLOUR OR STARCH FROM POTATOES.

Sir,—I feel extremely sorry that my commentary on the extract from the "Caledonian Mercury," should have so discouraged your worthy correspondent "X.X.,"—it being far from my intention to cut short useful experiments, or to paralyze the hand of philanthropy. It is true, I did throw a little cold water on the subject, but with no other motive than to prevent persons who might be disposed to follow up the views of a writer, *from expecting too much and being disappointed.*

It is evident that X. X. has misunderstood me in several particulars. Though I did say *flour*, I never said *starch*, could not be obtained from potatoes. Starch is a simple vegetable substance, which exists in many roots and seeds, under slight modifications as to its taste and stiffening qualities; but the article commonly called wheat flour is a compound, consisting of a variety of substances which differ greatly. The writer in the "Mercury" has used the two words *flour* and *starch* as synonymous, which has been the occasion of much confusion on the subject. No two things can be more dissimilar than starch and gluten. The latter is the essential, the characteristic ingredient in flour; it cannot be flour without it, and without it true bread cannot be made. And to this I think every chemist will subscribe. Flour will bear the addition of some starch, and still make good bread; particularly when the gluten predominates. A third or fourth of starch may be added, and it will then *produce a finer and whiter loaf.* Equal parts of flour and starch will make excellent biscuits, which will keep sound a long time. There are, however, proportions beyond which you cannot go, without spoiling your loaves or biscuits. Although I am strongly of opinion, that the advantages to the nation would be great, if potatoes were cultivated for this express purpose, yet I cannot exactly subscribe to the *golden dreams* of the Caledonian chemist.

After these observations, it will appear strange to X. X. and your other readers, that I should be much disposed to relate some *golden dreams* of my own; one in particular, which has for its object the production of a certain article of food, in a much cheaper way than any hitherto employed. Do not suppose, Sir, that I have any jealousy of the writer in the Mercury: far from it; for if his views were acted upon, it would only pave the way for mine. Though I have so far kept this dream a secret, yet I will not "die a traitor to mankind."

I am, Sir,
Your's, &c.
BENJAMIN GOULSON.
Pendleton, Dec. 6, 1827.

Sir,—Finding, in the 233d No. of your very useful Magazine, an inquiry by X. X. for a description of the process of separating potato flour or starch, I requested from my housewife an insight into the mystery, and have superintended the whole process, which I will endeavour to describe.

The potatoes being well washed, must have a *thick* peel taken off, cutting out any deep eyes that may appear, that no sand may be left on the surface of the potato, nor any of its substance immediately under the skin. Of the potato thus peeled, I took 24 ounces, which was then grated by hand through a large tin grater, over a fine hair sieve nearly submersed in a basin of water; the pulp thus produced, which assumes a light frothy appearance, is then thoroughly washed by working it well with the hand, changing the water frequently by letting it rise through the sieve, which is frequently lifted to let the water run off; some water must then be poured through the pulp, which is, lastly, squeezed as dry as possible. The water in the basin will now be found thick,

and of a milky or reddish appearance. The pulp thus squeezed into a ball, occupied little more than one-fourth of the space of the peeled potato, and weighed 6¼ ounces. After standing half an hour, the water may be poured off, and the flour will be found adhering to the bottom of the basin in a solid white mass; in this state it has little taste, but leaves on the palate a very unpleasant, and what I suppose to be the *mawkish*, taste mentioned by Mr. Goulson in your 213th No. This flour must now be washed in six or seven waters, stirring it well, and pouring off the water each time, after it has settled as before. When this has been frequently repeated, using fresh spring water, the flour will appear dry and crisp to the touch, and be of a snowy whiteness, possessing no perceptible taste; it must now be spread on paper and thoroughly dried, and is best preserved in paper bags in a dry closet.

I obtained 4 ounces of the dried flour from the 24 ounces of potato, 6¼ ounces of pulp remaining in the sieve; 13¾ ounces being the weight of the juice of the potato, which discoloured the water.

X. X. was correctly informed by the bakers, who are, doubtless, ignorant of potato *flour*; but, had he extended his inquiries to mashed potatoes, he might have learned that large quantities are used mixed with the flour, or smaller quantities with the yeast, *greatly to the improvement of the bread*,—it being a very erroneous idea that the best bread can be made from wheat flour alone. The most mealy potatoe will produce the greatest quantity of flour, whilst a waxy potato will scarcely produce any. Those I used were tolerably good, but very far from being the best. Some of this flour I have had mixed with boiled milk, which was tasted by all the family, who have searched in vain for the *mawkish* taste; no difference can be perceived in this from the smoothest and very best arrow-root. Should any of your readers, having accurately followed these directions, and having proceeded thus far, doubt the excellence of this flour, from its appearing coarse and rough, let him take means to crush it extremely fine; I shall then request him to state in your Magazine any reason that may appear to him, to believe this to be any other than what is sold in England as the best and finest arrow-root. It being absolutely necessary, in obtaining this fine flour, to pare off a considerable thickness from the outside of the potatoes, it will afford employment for the mechanical ingenuity of some of your numerous readers, less usefully employed, to produce a machine that will accomplish this expeditiously; which, with a machine for grating and washing, I should be glad to see inserted in your Magazine.

I remain, Sir, &c.

J. S.

West Brixton, Dec. 9, 1827.

[Mr. Alwin on the same subject in our next.]

THE LATE FELIX FORD.

We feel now placed at liberty, by a communication we have received, to lift the veil which concealed the real name of this valuable and lamented correspondent. "Felix Ford" was an anagrammatical transposition of "Froxfield" (Wilts), and the usual name (though not the only one) by which the late venerable vicar of that parish, the Rev. Lewis Evans, F.R.S., gave the "Mechanics' Magazine" the honour of his active support. The following tribute to his memory we extract from the "Reading Mercury;" and to it we shall subjoin a few additional particulars, for which we are indebted to a friend of the deceased:—

"On Sunday, November 18, died, at the Vicarage, Froxfield, Wilts, aged 74, the Rev. Lewis Evans, F.R.S., Perpetual Curate of Knowle, St. Giles's, Somerset, and for thirty-nine years Vicar of Froxfield, whither he had retired in 1821, after a residence of twenty years at Woolwich, in the office of Mathematical Master to the Royal Military Academy. Of his mathematical attain-

ments, an estimate has been probably formed from the productions of his pen already before the world. They were, however, with few exceptions, the amusing occupation of his leisure from severer studies; of the latter, it would be tedious and superfluous, on the present occasion, to say more than that, although, for the most part, he kept pace with the general, and more especially the professional, literature of his time, yet his leading pursuits through life were those of science; in two branches of which, physics and astronomy. few men, perhaps, have attained greater proficiency. With respect to his private character, he was remarkably single-hearted, frank, and generous, warm in his attachments, and gladly and liberally communicating, from the stores of his knowledge and experience, to all who manifested a desire to profit by them. To this kindly feeling, which was often gratuitously indulged towards the children of parents whose means were unequal to the expense of such instruction, even if it could have been conveniently procured, it is possible that some of those who read these hasty lines may be able to bear testimony. Habitually, and from principle, correct and punctual in every transaction of life, he retained the confidence and esteem of all who knew him; while his active benevolence, cheerfulness, and sincerity, failed not to secure to him their regard. He died, after many years of suffering, from an incurable bodily ailment and chronic dyspepsy, with great serenity of mind, and at peace with all the world, in the full and firm belief in the faith of that excellent church of which he was a minister, in the humble hope, through the merits of his Saviour, of a joyful resurrection."

For many years Mr. Evans filled, with the greatest honour to himself and benefit to the Academy, the situation of first Mathematical Master at Woolwich; from which, after twenty years' service, he retired, with a very handsome acknowledgment on the part of Government, full of years, but with a constitution much shaken by severe application. He was succeeded by Dr. Olinthus Gregory.

Among his friends and acquaintance, he numbered Bonnycastle, Hutton, Robertson of Oxford, and many others of the most eminent men of science of the age in which he lived. To Mr. Evans, for upwards of ten years, was entrusted the entire criticism of mathematical and philosophical works, by the acute and learned editors of the "British Critic,"—a periodical which has ever stood high in the opinion of the learned. His MSS., which are numerous, have, with the exception of occasional anonymous contributions to different periodicals, been confined to his own study. One of them, however, on the Binomial Theorem of Newton, found its way to the Royal Society, which immediately enrolled him amongst its Fellows. Having retired to enjoy a literary "otium cum dignitate," he partially regained his health; but almost immediately after he had forwarded to the "Mechanics' Magazine" his last *bagatelle* on Darley and Euler, he was seized with alarming spasms, which terminated his existence.

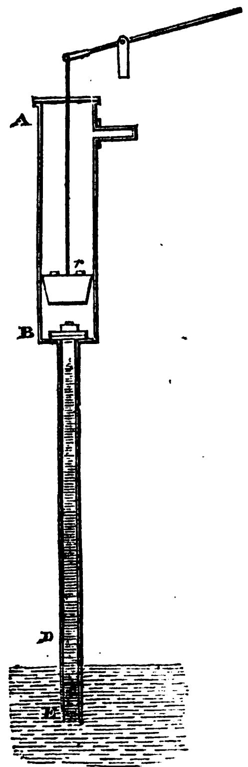
Erratum.—The mathematical question, by the solution of which Mr. Evans soothed one of the latest hours of life, was somewhat erroneously given in our 223d Number, p. 317. It was not to be solved *by*, but *without*, a quadratic equation. The difference, it will be seen, is of material importance; as the working of it by a quadratic considerably abridges the difficulty of the task.

THE PNEUMATIC AND HYDRAULIC INQUIRY.

Sir,—I take the liberty to express my opinion respecting the pneumatic and hydraulic inquiry, No. 214, page 169.

Let A B represent the pump, and B D the feed-pipe, 26 feet in length, from the valve B to the surface of the water D; then $34 - 26 = 8$ feet $= \frac{8}{26}$, the superincumbent atmosphere. Let $a =$ the diameter of the pump A B, and x that of the pipe

B E, then $a^2 = 4x^2$. Hence the velocity of the water through the pipe B E equals four times the velocity



of the bucket r in its ascent—when the law of resistance is as the density and square of the velocity. The body being a cylinder, let $P = 3{\cdot}1416$, $r =$ its radius moving in direction of its axis, $s = 1$, $v =$ its velocity, $e =$ its density, or specific gravity of the fluid, $z = 16\frac{1}{12}$ feet, or 193 inches, and $w =$ the weight of the body, whose area is the absolute force of resistance: then $\frac{P\,e\,v^2\,r^2}{4\,z} =$ the resisting force, and $\frac{P\,e\,v^2\,r^2}{4\,z\,w} = 98{\cdot}175$ lbs. or $98\,\frac{175}{1000}$ lbs. the retarding force—that is the value of resistance when the cylinder is perpendicular to its axis. Consequently it will make no possible difference what depth the pipe B E is immersed under the surface of the water D. But the only remedy is to have the pipe B E three inches in diameter, instead of two inches. We experience similar effects in our large pumps in this country, by the accumulation of the particles of strata in the feed-pipe, which contracts the aperture, and consequently retards the motion of the engine.

I remain, Sir,
Your's, &c.
W. TONKIN,
Mine Agent, Wheal Howell, by Fowey, Cornwall.

FIXING BLACK-LEAD WRITING.

Sir,—Having observed, in the "Mechanics' Magazine" (Number 219), "directions to fix black-lead writing," I solicit permission, through the medium of your truly valuable Publication, to inform those of its readers whom it may concern, that a better method to fix black-lead writing or drawing, (and which requires no previous preparation of the paper,) is to spread the writing or drawing on a table, then pour on the same a small quantity of skim-milk, which will not soil the paper, and which may be directed to any part of the drawing, by gently raising, alternately, different edges of the paper. When the whole of the drawing has been covered with the milk, hang the paper against an upright board, by means of a pin, or small nail, through one of its corners; in which state it must remain till quite dry, when the drawing will be so fixed, as to resist the effects of Indian-rubber. If the above method of applying the milk should, in any case, prove impracticable, a fine camel's hair brush will answer the purpose, if carefully used.

I remain, your's truly,
K. B. G.

GALENA.

Sir,—A and B have a dispute respecting the lead ore commonly called galena. A asserts galena to be the proper name, which B denies; he conceiving that the proper name must be what the substance actually is—native sulphuret of lead. Each party being equally positive in his

opinion, it was agreed to refer the subject in dispute to the decision of the Editor of the Mechanics' Magazine. The favour of your opinion on the above will much oblige, Sir,

Your's respectfully,

TWO CONSTANT READERS.

Dec. 11, 1827.

Opinion.

Galena is the common, *sulphuret of lead* the scientific, name of this substance. But though it receives the latter appellation, because it consists chiefly of *sulphur and lead*, it contains almost always a portion of some other mineral, as silver, arsenic, iron, antimony, &c.; sometimes there is nearly as much iron as sulphur. Galena being therefore the more comprehensive, appears to us to be the more proper, name. It has also the recommendation of being more generally understood. We should say galena, rather than sulphuret of lead, for the same reason that we would say *plumbago*, not *supercarburet of iron*; *sea salt*, not *hydrochlorate of soda*; *Prussian blue*, not *cyanide of iron*, &c.—EDIT.

ELECTRICAL CONDUCTORS.

Sir,—I am so tired of such incomprehensible remarks from "Amicus" and others, as to decline any further comment, and therefore solicit your insertion of this note in your next number.

I am, Sir,

Your humble Servant,

W. PRINGLE GREEN,

Lieutenant R. N.

7, *James-street,*

Adelphi, 9*th Dec.* 1827.

[It is a pity, both for Mr. Green's own sake and for truth's sake, that he should have lost his temper. Whatever may be the merits of his opponents' arguments, they can least of all, we think, be charged with *incomprehensibility*.—ED.]

LONDON

MECHANICS' INSTITUTION.

NO. XIV.

Friday, November 2d—Mr. Wallis, on Astronomy.

Wednesday, November 7th.—Mr. Wallis.

Friday, November 9th.—Mr. Wallis.

Wednesday, November 14th.—Mr. Wallis.

Friday, November 16th.—Mr. Wallis.

Wednesday, November 21st.—Mr. Wallis.

Friday November 23d.—Mr. Wallis concluded his course, and recited Addison's hymn; after which he withdrew amid the applause of a numerous audience.

Wednesday, November 28th.—Dr. Birkbeck. A very interesting lecture on Mummies, the country most famous for them, and the art of preserving them; illustrated by some ancient and modern specimens of the art; the latter kindly supplied by Mr. Brookes.

Friday, November 30th.—Mr. Partington, on Friction.

Sixteenth Quarterly Meeting, Dec. 5.

Dr. Birkbeck, supported by Messrs. Millington, and M'William, Vice Presidents, presided.

The Secretary read the minutes of the last Meeting, which having been confirmed, he proceeded to read the Report of the last quarter.

The receipts for members' tickets had been 482*l.* 7*s.* 3*d.*, and for admissions for friends of members, at one shilling each, 12*l.*; the disbursements, 492*l.* 6*s.* 6*d.*; balance of cash in hand, 75*l.* 0*s.* 11*d.* The annual expenditure of the Institution was stated to be 1600*l.* The number of members at the beginning of the quarter was 1053; present number, 1238; average for the year, 1207.

The Committee felt it to be their duty to direct the attention of the members to the state of the roof, and to Professor Millington's report to the Committee, from which it appeared, that its dangerous state arose from want of skill in the construction.

The Committee had to return their thanks for many valuable presents of books, specimens, apparatus, &c.

The Classes were stated to be in a flourishing state. Gratuitous lectures had been delivered during the quarter, by Dr. Birkbeck, Messrs. Millington, Downes, and Wallis. Professor Millington and Dr. Birkbeck would shortly complete their separate courses; Mr. Hodgskin deliver a course on the Mind; and Mr. Christie one on Architecture.

The anniversary, it was announced, would be celebrated by a public dinner, at which the several prizes would be presented to the successful candidates;

but, on account of the absence of His Royal Highness the Duke of Sussex, from town (His Royal Highness having promised to preside), it could not take place sooner than January.

The Report concluded by earnestly exhorting the Members to make known the existence of the Institution amongst their connexions, and hoping that the copious detail laid before them would prove satisfactory.—(*Applause.*)

Mr. Nathaniel Adams, rose, and said he thought that some explanation ought to be given, touching the bad state of the roof, in order that the blame might be attached to those who deserved it, and that the Institution should not be put to the heavy expense necessarily incurred in its repair. It would, besides, be only doing justice to those under whom it was constructed—that if not to blame, they should have an opportunity of exculpating themselves to the general body. He believed it to be the usual custom, that when any building is erected, a surveyor, or some legally responsible person, is appointed to the work, in order that on him any blame or expense may rest, if the work prove defective; but he understood that those employed by the Committee gave their services gratuitously, and that however morally responsible they might be for this expense, they were not legally so. The roof, he had heard, was on a new plan, and that this was an experiment. He had heard of expensive trials before, but this exceeded any of them; they might be amusing and edifying, perhaps, to those who made them, but they should not be indulged in at the cost of others.—(*Much applause.*)

Dr. Birkbeck said, that unless the member who had spoken intended to bring forward a motion, the discussion of the question would tend to no good.

Mr. Adams. He merely asked a question on an important point, to which he thought the Committee were bound to give an answer.

A Member moved, that *Mr. M'William* explain.—(*Confusion.*)

Mr. M'William came forward amidst mingled applause and disapprobation. He said, it was always unnecessary to make a motion for him to explain; he was ever ready to do so. A member (Mr. Clarke) had been busy in getting up a petition to the Committee, blaming him; he despised the calumny which had arisen from personal animosity. It was not fair to come on the Committee in this manner; they did what they considered most effective, and for their services they were not paid—they were entirely gratuitous. The Building Committee was one of their own election, and they were to blame if they chose to nominate a set of blockheads. He was surprised at Professor Millington's curious document. The Professor had not given the building any attention; it was his duty to have done so, and if he had discovered any thing defective, to have pointed it out. The gentleman who opened the question, had talked a good deal of expense, but as yet none had been incurred; and until then the question was not ripe for him to discuss. He should be ready, when any charge was made, to render whatever explanation he might consider due.—(*Partial approbation.*)

Mr. Clarke explained. He had no dersonal animosity—he had not solicited signatures; what he did was for the good of the Institution. He had been informed, that the expense of the repairs would come to 200*l.*, but he was well aware that the Institution, not being a corporate body, could not sue any one for the recovery of this damage.

Professor Millington then came forward, and was received with loud cheers. He felt himself called on from what had fallen from Mr. M'William, to say a few words. He disclaimed any thing personal in his report, for he did not know who was the constructor of it. He had been called on by the Committee to examine and report on its state, and this he had done to the best of his ability (*Applause*). He confessed that his attendance at the Institution had not been so regular as it ought to have been, but unfortunately he was prevented at the time of the building, by circumstances, of which no doubt the members were aware, from giving it that attention which be ougbt to have done.—(*Loud appplause.*) But he certainly should have felt it a piece of impertinence on his part, to have interfered with the Building Committee, having full confidence that it was composed of ingenious mechanics. He concluded by moving "That a committee of inquiry be appointed to examine into all the circumstances connected with the roof; to give a decisive report, and see who (if any one) really was the blameable party."—(*Much applause.*)

A Member seconded the motion.

After a long and unimportant discussion on the proposition, Dr. Birkbeck put the motion, and, in so doing, expressed a hope that the examination would tend to exculpate those who were concerned in the erection of the roof.

The proposition was then carried,

amidst a round of applause. Nine members were then nominated to compose the committee of inquiry.

Professor Millington brought forward the following proposition, duly signed, to be considered next meeting, "That any person wishing to become a member in the course of a quarter, should, on the half-quarter day subsequent thereto, be admitted on paying half a quarter's subscription, provided at the same time he pays for the ensuing quarter."

A Member was anxious that the term "working class," should be properly defined, as regarding the qualifications of candidates for the office of a committee-man. He wished to know whether it meant *journeymen* only, or whether persons might be included in the term, who work at their trade as well as employ others. This was a distinction which he thought should be determined, as he knew masters of the working class who, on this ground, declined offering themselves as committee-men.

Votes of thanks were then passed to the lecturers, &c.; to Mr. Christie, the Secretary; and to Dr. Birkbeck, for his able and impartial conduct as Chairman. (*Cheering.*)

Dr. Birkbeck then returned thanks.

The worthy Chairman, who on this evening had a most difficult and delicate part to sustain, and which he did uphold with the greatest impartiality, then retired amidst the hearty gratulations of the members.

The Committee have partially, it seems, attended to the hint thrown out by a member last quarter, and which was laughed at by one of their number, namely, that of issuing hand-bills or prospectuses of the Institution, and the good to be derived from it. On Friday last, papers of this description were distributed, to which is annexed a short address on the completion of the fourth anniversary, viz., Sunday, Dec. 2, and Dr. Birkbeck's speech on laying the first stone of the Theatre.

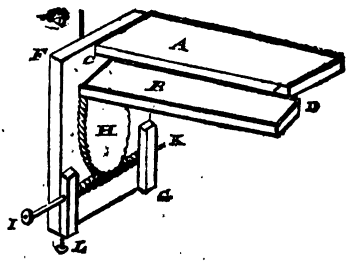
☞

NEW OPTICAL INSTRUMENT,

INVENTED BY MR. W. SHIRES, MATHEMATICAL TUTOR.

The object proposed to be effected by the present instrument, is to bring the reflections of three celestial bodies into a straight line.

Construction.



Let A and B be two silvered plate glasses, the glass A to be fixed to wood (&c.) F G, at right angles to each other. The glass B is, in like manner, to be fixed to the section of a cog-wheel H, whose centre of motion is C; an axis C D connects the glasses as a hinge, and an endless screw I K being applied to the cog-wheel, as per figure, will admit of turning the glass B to form any angle with A, and thereby to bring the three reflections to correspond with the edge C D of the glass A.

Note.—L is a screw to clamp the screw I K against H, in case of the glasses being required to be fixed at any desired angle.

W. S.

NOTICES TO CORRESPONDENTS.

Mr. Gurney's New Steam Carriage is undergoing a number of most important alterations; as soon as it is perfected, we shall not be behind-hand in laying a description of it before our readers. The account of it which has appeared in a newspaper, is wholly premature. D. Z.—Monitor—F. N.—and others, will, we hope, be satisfied with this explanation.

Mr. Ibbetson has accepted the sort of challenge given by Mr. Child in our last Number, and will next week favour our readers with some further specimens of his eccentric turning.

Communications received from A Subscriber—T. M. B.—J. W.—Mr. Saul—Mr. Baddeley—G. L.—Mr. Hingston—D. F.—293—Cycloid.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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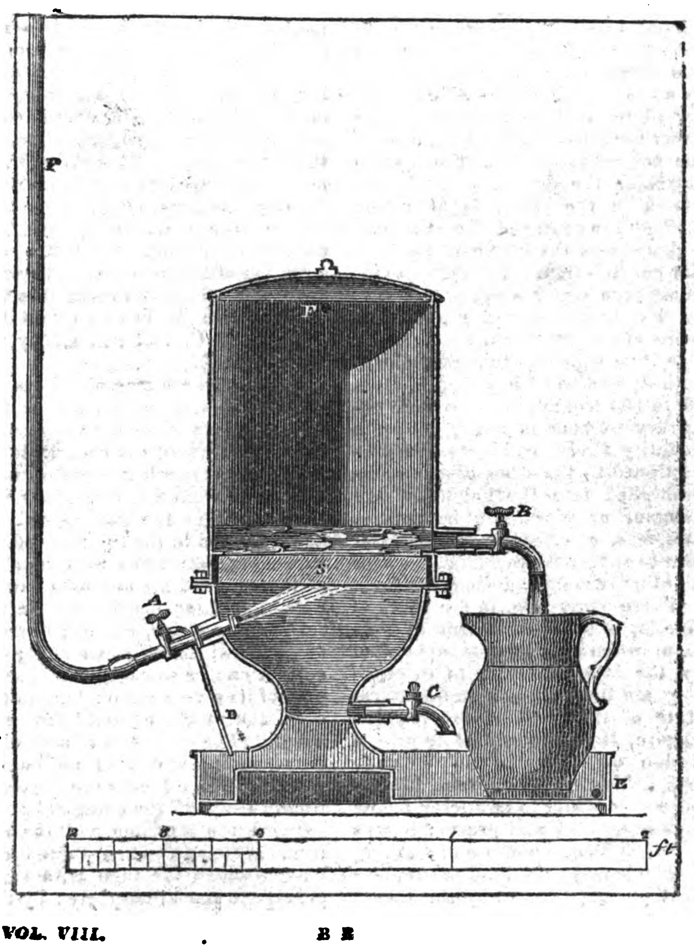
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 227.] SATURDAY, DECEMBER 29, 1827. [Price 3d.

Mr. Locke was asked, "how he had contrived to accumulate a mine of knowledge so rich, yet so extensive and so deep." He replied, "that he attributed what little he knew to the not having been ashamed to ask for information; and to the rule he had laid down, of conversing with all descriptions of men on those topics chiefly that formed their own peculiar professions or pursuits."

PATENT ARTIFICIAL SPRING.



PATENT ARTIFICIAL SPRING, OR A NEW MODE OF FILTERING WATER, INVENTED BY MR. JAMES WHITE, ENGINEER.

(For the Mechanics' Magazine.)

When new inventions which promise to be of public utility present themselves to our notice in a simple form, a degree of surprise is excited, that they should hitherto have eluded the research of ingenious men, whose lives have been devoted to mechanical pursuits. It is certain, there are but few things of greater importance to the comfort of every family than water, which shall be good in quality, and provided in sufficient quantity for all the purposes of domestic use. That both these effects are produced by this invention, will be best shown by a description of the accompanying plate, and an account of the experiment as tried at the house of the nobleman who was the first to patronize the design. The fig., as shown in the plate, is a section through the centre of the machine, which shows the whole of its interior construction. The cistern containing the water is not introduced, as its height would exceed the limits of the plate; but let the small pipe P be supposed to communicate with it, and be of any length, from 10 to 100 feet: it is, however, necessary to bear in mind, that the quantity filtered will always be proportioned to the area of the stone multiplied into the height of the column, or pipe; the advantage, therefore, of employing a high cistern to supply the machine, requires no other recommendation.

Three years ago, in the south of Russia, in the Government of Poltava, when on a mission appointed by the late Emperor, to examine the mechanical and agricultural state of that part of the Russian empire, it fell to my lot to give a design for filtration on a large scale. To effect that object, I introduced the water to be filtered below a bed of sand and gravel: it was intended for the purpose of washing wool; consequently, did not require that purity produced by this invention: but at the house of the nobleman I have already alluded to, I attached a half-inch lead pipe to a cistern, which was already fixed, 35 feet above the ground-floor, where I placed the machine; the other end of the pipe I made water tight, by fixing it to a nozzle in the apparatus, below a proper filtering-stone. Upon turning the cock A, which shuts off the communication betwixt the machine and the cistern, the water rushed down from the cistern with great force, and very soon displaced all the air contained in the apparatus, through the pores of the stone S; after which the water began to ascend, and to flow in a filtered stream at the cock B, so as to fill a gallon measure in about two minutes' time. Its appearance in small bubbles, rising through every pore in the stone, from the great pressure of the column of water contained in the small pipe P, suggested to me the name which I have given it, of an artificial spring; and further experience has fully convinced me that I have not applied to my invention an unmerited title. From the construction of the apparatus, the sediment and animalcula will fall to the bottom, and be drawn off at the under cock C, and run off by the waste-pipe E.

In cases where several gallons are wanted at the same time, and it might be inconvenient to wait until it be filtered, shut the cock B, leave A open, and in a few minutes, with a pressure from a cistern of 30 feet high, eight or ten gallons will be found filtered in the top part of the apparatus, which can be drawn off at B for immediate use, as required. Should it filter more than the top reservoir contains, while A remains open, it will run off waste at F; the cock A can be so constructed, as to shut of its own accord: but, in this case, the machine would not be so simple. The cock A is of a peculiar construction, and well merits the attention of the reader; at the same time it shuts off the communication betwixt the machine and the cistern, it opens, when turned one way, through the tube D, a small passage to the atmosphere: by this

contrivance, the filtered water in the top part of the machine is allowed to subside the contrary way through the stone,—a process which must naturally tend to wash its pores clean; and we know that all filtering substances are subject to get clogged up from particles of fine sediment lodging in their pores; but what back filtration does not remove, in my invention, another beautiful and simple phenomenon completely effects. Open the under cock C, and then shut it again as fast as possible; this will produce an immense pressure on the stone, and the water will be forced through with so much rapidity, as to clean its pores completely. From what cause I have not yet been able to ascertain, but it invariably happens, after the process of forcing the air through the stone, that the power of filtration is diminished considerably, and it is several hours before its power is restored. It may be presumed that the air lodges in the pores of the stone, and shows considerable obstinacy in being removed. When back filtration is not required, (for it is only necessary for keeping the stone clean,) the cock A must be shut off, with the notch in the top of it towards the machine, and the filtered water can be retained in the top part of the apparatus for any length of time. Having briefly described the nature of my invention, it remains for me to add, that it is an application of the hydrostatic paradox to the filtration of water—the nature of which admits of its being extended to any magnitude: for example, at the house where my first experiment was tried, the altitude of the cistern was 35 feet, and the area of the stone contained 113 square inches, which sustained an upward pressure from the column of water in the pipe P of 1853 pounds, and the product of filtration was at the rate of half a gallon per minute; and since the altitude of the pipe into the area of the stone proportions the quantity, it is a simple question to find what area and altitude together would produce 10, 20, or 100 gallons of filtered water every minute. To produce such effects, a number of stones must be used in the same machine. I believe it yet remains to be proved whether filtered water preserves as well at sea as that which is not filtered. I conceive it will be found to keep equally well, or perhaps better, as filtration removes all animal and vegetable matter which it holds in suspension—the former, frequently, both in a live and putrid state—a circumstance which cannot reasonably have a tendency to preserve water. Should experience prove that my surmises are correct, I would propose, for the benefit of the shipping interest in general, that a machine on a large scale should be erected at every sea-port where ships are in the practice of taking in water, which should be sent at once filtered to sea.

JAMES WHITE.

No. 387½, *Oxford-street.*

ON PILE DRIVING AND FORCE.

Sir,—I think your correspondents, Messrs. Mackinnon and Barrat, are greatly mistaken in their estimate of the comparative force of the pile-engine, when the weight or ram falls from different heights. Mr. M. (No. 210) says, "By inspecting the Table, (No. 198,) we perceive that the momentum of a body falling 16 feet is one-half of the momentum of the same body falling 64 feet; whereas the labour in raising the body 16 feet is only one-fourth. The same ratio holds with respect to all other heights," &c. Mr. B.'s Rule (No. 209) is, "Multiply the perpendicular height by 16 and 1-12th feet; take the square root of the product, and multiply it by 2, which gives the velocity acquired. This multiplied by the weight of the ram will give the velocity required."—Both gentlemen making the effect of the ram to vary according to *simple* force, whereas it is evident to me it ought to be measured by *living* force. To show the difference in these two forces, let W and w be two weights moving with the uniform velocities V and v; the products W V, w v, will measure the

simple forces. Let A and a denote the altitudes from which these weights must fall, to acquire the velocities V and v; the products W A, $w\ a$, will measure the *living* forces. But according to the established theory of the fall of heavy bodies, if S be the space described by a heavy body falling in the first second from quiescence, we shall have $4\ S\ A = V^2$, and $4\ S\ a = v^2$; therefore the products W A, and $w\ a$, which measure the living forces, are equal to the quantities $\frac{W\ V^2}{4\ S}$ and $\frac{w\ v^2}{4\ S}$, for $A = \frac{V^2}{4\ S}$ and $a = \frac{V^2}{4\ S}$. So these forces are in the ratio of $W\ V^2$ to $w\ v^2$, whilst the simple forces are as W V to $w\ v$; or, in other words, the former are as the *square* of the velocities, and the latter are as the velocities *simply*. The resistance which is opposed to the moving body I have reckoned as uniform. If it be not, the force will not be proportional to the square of the velocity, but to a *function* or *expression* of the velocity.

Now, as the percussion of the weight or ram acts on the pile during the whole time the pile is penetrating and sinking in the earth, by each blow of the ram (during which time its whole force is spent), it is manifest that the effect of the blow is of that nature which requires its force to be estimated by the square of the velocity; and the square of the velocity acquired by the fall of the ram is as the height it falls from: therefore, the force of any blow must be *as the height fallen through, multiplied by the weight of the ram;* or it will be simply as *the height*, when the weight of the ram is constant.

The force of the ram being as the height multiplied by the weight, it is clear that the higher the ram is raised, the greater will be its effect. But as the time is longer when the height is greater, both in the raising and falling of the ram, it may be asked, What height will produce the greatest effect in a given time? According to the solution of the question in Hutton's 3d volume of Mathematics (from whence part of the foregoing is taken), it appears the effect will be increased in the given time, the higher the ram be raised above the pile.

The following Table shows the difference that will result, in estimating the effect of the ram according to the *velocity simply* (which is Messrs. M. and B.'s method), and in estimating it according to the *square* of the velocity, or the *height fallen through*, which is the method made use of in this paper.

Weight.	*Height fallen through.*									
	5 Ft.	10 Ft.	15 Ft.	20 Ft.	25 Ft.	30 Ft.	35 Ft.	40 Ft.	45 Ft.	50 Ft.
1 cwt.	17·934	35·868	53·802	71·736	89·670	107·604	125·538	143·472	161·406	179·34
1 cwt.*	17·934	25·364	31·064	35·870	40·104	43·930	47·450	50·728	53·804	56·714
Difference	......	10·504	22·738	35·866	49·566	63·674	78·088	92·744	107·602	122·626

By your inserting the above in your useful Magazine, you will oblige,

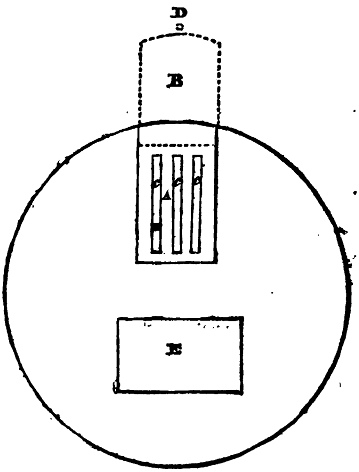
AN OCCASIONAL READER,
(*At Tisbury.*)

SUPERIOR BEE-HIVES.

The boxes which are generally made for bees, are much too cold in winter, and too hot in summer, and a great deal too expensive for the lower class of people. The wood and labour of a common bee-box cannot be estimated at less than five or six shillings, while those I am about to describe may be made for less than we can buy straw ones, and answer the same purpose as a wooden box; are sufficiently warm in winter, and proportionally cool in summer.

* This line is taken from Mr. B.'s Table.

Provide a straw hive without a crown, the same width at top as at



bottom; then procure (according to the drawing) a piece of deal board, about an inch larger all round than your hive, and an inch thick; at A cut away the board about half the thickness, so as to admit of the slide B; then, under the slide, must be made three holes, half an inch wide, and nearly as long as the side (which must be made of wood too); D is a small brass knob, to pull out the slide; E a small piece of glass, through which you may see the bees work. This board, being nailed fast to your hive, forms a top, which serves exactly the same purpose as a wooden box, and at one fourth the expense.

I am, Sir, yours, &c.

ALPHA.

Doncaster, Dec. 6.

SOLUTION OF BONNYCASTLE'S QUESTION OF "THE DISHONEST BUTLER," AND REMARKS ON SOME COMMUNICATIONS BY MR. SHIRES.

Sir,—Having a few days since met with "Bonnycastle's Arithmetic," the question proposed by your late correspondent, *Felix Ford*, attracted my attention. According to Bonnycastle, the theft was discovered after thirty days, when the quantity of wine which the butler robbed his master of was required. Now, according to your correspondent, *Felix Ford*, 23·53681 gallons remained in the cask when the theft was found out, from which it is required to find the number of quarts taken from the vessel. And as the answer is not given by Bonnycastle, I shall, with your permission, insert them both, that your readers may judge whether the questions are similar, and consequently whether Tay's observations, (vol. viii. page 91), will constitute a *retort courteous!*

Now, as the cask contains 168 quarts, $\frac{1}{168}$ part of the wine contained therein must be taken out in succession.

Example.

168)168· quarts
—1·

168)167· rem. after the 1st qt. is drawn
—0·99405

168)166·00595 rem. after 2d ditto
— ·98813

168)165·01782 rem. after 3d ditto
— ·98225

168)164·03557 rem. after 4th ditto.

If this process is continued till the 30th quart is drawn, we shall then obtain the quantity remaining in the cask where the theft was discovered; or it may be more readily obtained as follows:—

$$\frac{\text{30th power of } 167}{\text{29th power of } 168} = 140{\cdot}451 \text{ quarts, or}$$

35·1128 gallons, as required *(per Bonnycastle)*.

Vol. viii. p. 80, are given the contents of the cask=42 gallons=168 quarts; and the quantity remaining in the cask, 23·53681 gallons= 94·14724 quarts; whence,

$$\frac{\text{Log. } 168 \text{ quarts} - \text{Log. } 94{\cdot}14724 \text{ quarts}}{\text{Log. } 168 - \text{Log. } 167}$$

$$\text{Or } \frac{\text{Log. } 2{\cdot}2253093 - 1{\cdot}9738077}{\text{Log. } 2{\cdot}2253093 - 2{\cdot}2227165}$$

$=\frac{\text{Log. } 0\cdot2515016}{\text{Log. } 0\cdot0025928}=97$ days, the time required.

Proof.

$\frac{97\text{th power of } 167}{96\text{th power of } 168}=94\cdot147264$ quarts, or 23·536816 gallons, as per Question.*

The difference of the logarithms in the numeration, is *divided* by the difference of the logarithms in the denominator, and not *subtracted*, as is usually done, by the logarithmic method of computation. The above solution is, perhaps, rather a novel one, as I do not recollect ever to have seen a *direct* solution given to a similar question.

I take the opportunity of adding a few remarks on two communications of Mr. Shires.

1st. In respect to Mr. Shires' method of ascertaining the diameter of a round tower, by means of observing a fixed star in contact with the opposite sides of the tower, this method is certainly much more simple and correct, and may be ascertained with much less trouble, than that given in No. 225 of this Magazine. Without committing any error, the star may be considered at an infinite distance, and consequently the rays of light passing each side of the tower, may be considered as actually parallel; and, therefore, if the distance is measured at right angles to these lines, it will be correctly equal to the diameter of the tower, whatever distance the observer may be from it on the earth's surface.

2dly. Mr. Shires informs us, (vol. v. page 286), that if we have the *proportional distances* of the *sun* and *moon*, then we may find all the *distances*, *magnitudes*, *gravities*, *densities*, and *periodic times*. Now, I really must expose my ignorance as to the mode of calculation by which this is to be effected; and trust that your correspondent will explain it in such a manner as will be satisfactory to such of the readers of the Mechanics' Magazine as may, like myself, be ignorant of the process to be employed in the computations.

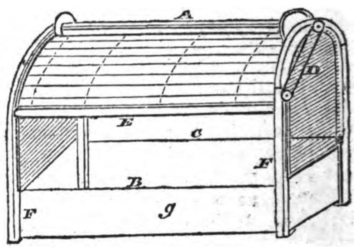
J. UTTING.

Lynn, Dec. 1827.

* Answers have been also received to this question from Mr. Russell, Mr. C. Clarke, W. Q., and Calculator.—ED.

WINTER AWNING FOR TULIP BEDS.

Sir,—As the season has now arrived, when the florist must be making his preparations for protecting that beautiful and costly flower, the tulip, from the frost and snow, I avail myself of the medium of your widely circulated Journal, to send you a drawing and description of a frame, or awning, which I have found exceedingly well adapted to the purpose.



A piece of canvas is made to pass over a roller fixed at A, down to B and C, and is then nailed on the roller. By drawing the cord D, which turns the roller A, both sides are drawn up at the same time. There is a small roller fixed to the canvas on each side at E, which keeps the canvas stretched, and moves in a groove at each side. At F the canvas is represented drawn up to the circular part, and the dotted lines are to show that there are ribs of wood fixed to make the canvas carry the water off. The canvas is done over with a mixture of boiled oil, bees-wax, rosin, and white lead, to prevent it from decaying; *g* is a board fixed round the bottom of the frame; the ends are latticed, so as to give a free circulation of air.

I remain, Sir,
Yours, &c.
M. SAUL.

Sulyard Street, Lancaster, Dec. 5, 1827.

ON THE MEASURE OF A POWER CALLED A HORSE'S POWER.

BY MR. THOMAS TREDGOLD, ENGINEER.

(From the "Repertory of Patent Inventions.)"

The term horse's power, used as the name of a measure of power, is an expression which has had its origin in convenience; it refers to a degree of power familiar to every one; and like the names of other species of measures, has been taken from that source which renders it most easily understood to the greatest possible number of persons. Dr. Young, with his usual discrimination, remarks, that "Measures have apparently always been derived, in the first instance, from some part of the human person; a foot, a pace, a fathom, the orgyia or stretch of the arms, a cubit, a palm, and a finger; these have probably all been used in the earlier states of society by each individual from the magnitude of his own person, and afterwards a standard measure has been established by authority, from the real or supposed magnitude of the person of some king, or hero, in order for the attainment of more perfect conformity in practice; though it is said, that in some parts of the East the Arabs still measure the cubits of their cloth by the fore arm, with the addition of the breadth of the other hand, which serves to mark the end of the measure, as the thumb which was formerly added at the end of the yard by the English clothiers. It ought not, however, to be forgotten, that any one of these terms possesses an advantage, for popular use and for the convenience of future ages and of remote countries, which would be lost by the introduction of any more arbitrary measurement; thus, a hand's breadth, or a foot, is always sufficiently understood, without any definition, to enable us to form to ourselves a tolerably accurate picture of the magnitude intended to be described; and there is scarcely an instance of the caprice of denomination having ever extended so far as to make the measure called foot, in any country, so small as half a natural foot, or so great as two feet of an ordinary person, and certainly not of its amounting to three ordinary feet; while a metre, even to those who know that the word implies a measure, might as well have meant a mile, or an inch, or a quart, as a length somewhat greater than a yard."*

So it is with the horse's power; and in its first application no great nicety was necessary, as horses themselves varied in power to a considerable extent; but as the value of mechanical power became better understood, an exact measure, and uniformity in the practice of engineers, became more desirable; unfortunately, however, it was considered by a few authors, that it ought to coincide with the average power of a horse, and different averages had been formed by different individuals: Desaguliers made one average, Smeaton another, and Watt another; while later writers on animal power have gone far to show that all these averages are fallacious except for the ordinary duration of the day's work, and for this purpose Watt's is near the truth when a horse is trained to the labour.

But there is not an absolute necessity that the measure called a horse-power should be precisely the average; it is of infinitely greater importance that an exact measure, nearly coinciding with the power of a horse, should be uniformly employed under that name, so that the expression may be as definite to the mechanic as it is familiar to others. This Mr. Watt has done, by defining it to be a power equivalent to raising 33,000 lbs. one foot high per minute; but erroneous statements having got into circulation respecting the measure Mr. Watt called a horse-power, it may be useful to give it in his own words. "When Boulton and Watt set about the introduction of the rotative steam-engines to give motion to mill-work, they felt the necessity of adopting some mode of describing the power, which should be easily understood by the persons who were likely to use them. Horses being the power then generally employed to move the machinery in the great breweries and distilleries in the metropolis, where these engines came first into demand, the power of a mill-horse was considered by them to afford an obvious and concise standard of comparison, and one sufficiently definite for the purpose in view. A horse going at the rate of 2½ miles an hour, raises a weight of 150 lbs. by a rope passing over a pulley, which is equal to the raising 33,000 lbs. one foot high in a minute. This was considered the horse's power."*

The elementary horse-power, as fixed by Watt, is therefore 1,980,000 lbs. raised one foot per hour; or, 33,000 lbs.

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* Napier's Supplement to the Ency. Brit., Art. Weights and Measures.

* Watt's Notes to Robinson's Mechanical Phil. vol. ii. p. 145.

raised one foot per minute; or, 550 lbs. raised one foot per second.

When the horse-power is applied to measure other powers, as of water, wind, or steam, it must always be understood as above; that is, as the exertion of a horse when in action, without reference to the length of his day's work: if it were otherwise, the measure would be useless in conveying an idea of the immediate power of a first mover.

But when the equivalent number of horses for a given quantity of work is the question, then eight hours is to be considered the time the horse can work, with the above exertion, in each twenty-four hours. This I would distinguish from a horse's power, by calling it the "*day's work of a horse.*"

Mr. Watt further assigned a proportion for the low pressure steam-engine equivalent to a horse's power, which is 5·5 times the square of the diameter of the cylinder, in inches, multiplied by velocity of the piston in feet per minute, and the product divided by 33,000, the result is the number of horse's power.

A more appropriate rule for low pressure engines could not have been devised, as 5·5 lbs. per circular inch is extremely near to the mean pressure in an engine working expansively; and when an engine does not work expansively, the best use is not made of the steam, or, in other words, part of the effect of the fuel is wasted.

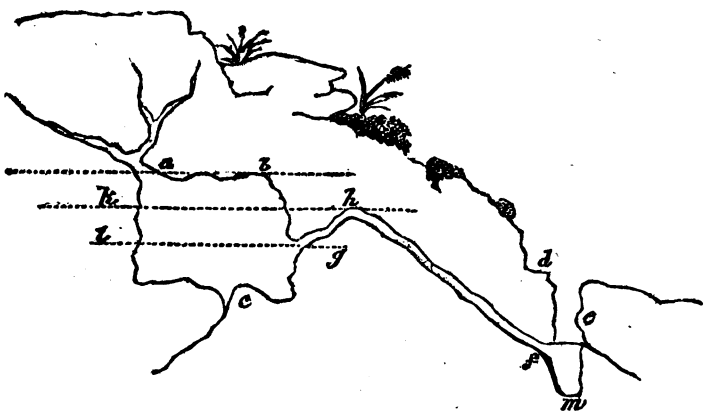
Considering the importance of a definite measure of mechanical power in this country, and that it is not yet made a part of the system of weights and measures established by law, I have stated these reasons for adhering to the data sanctioned by the practice of Messrs. Boulton and Watt, and strongly recommend attention to uniformity to engineers.

The advantage of steam power, as compared with horse power, will be more apparent, when it is clearly understood that the horse can work at that rate only eight hours in a day; whereas the engine may be kept at work ten, twelve, or even the whole twenty-four hours, for many days together. The engine horse power is, therefore, equivalent to three sets of horses; hence its economy—for the cost of an engine is about the same per horse power as one horse, and yet will do the work of three, and the fuel required is only about one-third of the value of the food a horse requires, both being supposed to be employed in this metropolis: where fuel is less expensive, the economy of steam power is still greater.

THOMAS TREDGOLD.

16, *Grove-place, Lisson-grove.*

GIGGLESWICK EBBING AND FLOWING WELL.



Sir,—Permit me to give another solution of the ebb and flow of the Giggleswick Well, on the principle of the syphon, mentioned by your intelligent correspondent, "The North Star."

Let *a, b, c,* be the reservoir; *e* a small aperture in it; *d, e, f,* the

well; e a small opening; and g, h, f, the syphon connecting them.

In dry weather, when the supply of water in the reservoir is very small, the aperture c is sufficiently large to allow it all to escape; and, consequently, the syphon is at rest, and likewise the water e, f, m, in the well.

Increase this supply; c then becomes insufficient, and the water in the reservoir will gradually rise to the height $k\ h$, when the syphon will begin to act, and consequently the water in the well to flow. This will continue till the water in the reservoir is decreased to $l\,g$; then the syphon loses its power, and the water in the well will gradually begin to ebb by means of the aperture e. Thus the ebb and flow in the well will be continued so long as this moderate supply remains.

Lastly, let the supply become greater than the syphon can consume; it is evident, then, that the syphon will be continually at work, and the water in the well steadily flowing.

From this, the conclusion is easily deduced.

In moderate weather, our well ebbs and flows — in very wet or dry weather, the phenomenon ceases. So it is with the Giggleswick Well; surely, then, this principle is far better than that mentioned by "Athelstan."

Yours obediently,

$\sqrt{S}$.

ON THE COMPARATIVE ADVANTAGES OF DRAWING AND MODELLING IN SHIP-BUILDING.

Sir,—Having been charged by one of your correspondents, who signs himself "Noah," with having asked a very foolish question about the best form for the bow of a vessel, without reference to that of the midship bend, I feel myself indirectly called upon to prove, or at least endeavour to prove, that it is not quite so foolish as it has been represented to be. I am well aware that it is difficult for an individual to bear ridicule, without feeling something like a sense of shame for having said or done that which is the subject of ridicule. However, as we are both *masked*, it cannot hurt either of us, if we have sufficient prudence to keep our own secret. My *foolish* question arose from a communication which appeared in one of your Numbers, upon Naval Architecture; in which the writer strongly recommended to students of Naval Architecture, the practice of modelling, in preference to drawing. I made some remarks upon that paper, and stated it to be my conviction, from experience, that drawing was the preferable method of study; and at the same time suggested a plan which I conceived would be as beneficial to others as I had found it to be to myself; and concluded by asking the *foolish* question—"What is the best form for the bow of a vessel?" requesting a description of the figure of the lines, given by sections in different directions. Unfortunately, it appears that my question was not sufficiently precise; and therefore I must beg that "Noah" will withhold his shafts until I have endeavoured to explain my intention in using the expression, "without reference to the form of the midship bend." Sir Isaac Newton long ago demonstrated the form of the solid of least resistance, in theory; and if that theory be correct, we have at once the figure best calculated for dividing the fluid with the least resistance; and, in my opinion, subsequent observations have confirmed its correctness. But as we have also to provide against the tendency of the ship to pitch in a heavy sea, and to go down by the head under a press of sail, it is evident that we must deviate, to a certain extent, from that form, in order to obviate the two evils I have just alluded to; and my intention was simply to direct the attention of the naval readers of the "Mechanics' Magazine" to the investigation of the form best calculated to secure the advantages of the least resistance in an horizontal direction, and the greatest resistance in a perpendicular and an oblique direction, with the least sacrifice of

any one of them. It is evident that the general principle may be pointed out, without necessarily taking into consideration either the form of the midship bend, or that of the quarter. I should not have suggested the inquiry, had I not known that the form of the bow is generally considered to be but of little importance; so much so, that I am inclined to think that the satirical remark of "Noah" might have been with equal propriety applied to the bows, as well as the quarters of merchant ships. Having explained myself, I trust, to your satisfaction, you will allow me to make a few observations upon the comparative advantages of drawing and modelling.

In order to form a model of a ship, so as to be calculated for practical benefit, it is necessary that the student should have previously acquired such a competent knowledge of drawing, as to enable him to design his intended model upon paper. If this be necessary, it appears to me quite absurd to talk of draughting as merely "copying transoms and fashion pieces"—yet such is the estimate which "Noah" has formed of an art, to which we are mainly indebted for the partial developement we now have of those general principles of construction upon which depend the velocity and capacity of vessels: were it not for this art, it would exceed the power of the nicest eye, and the most correct judgment, to discriminate between two models nearly alike, and pronounce at once where they agree, and where and how much they differ, and which is the preferable form of the two. In examining models, we are under the necessity of depending principally upon the eye (which, in this case, is not a competent judge), as it is well known that the most correct model, upon a small scale, will not give an adequate idea of what the structure will be when completed. We see the object under very different points of view; and all who are acquainted with the practice of Naval Architecture, are well aware how much depends upon the position in which the observer is placed, in order to form a correct idea of the form of the stern, for instance, and so of other parts of the hull. Now, in consequence of the great difference between the size of the model, and the actual vessel, it is much more difficult to describe what a vessel will be, from a model only, than from a drawing.

All the correct models that I have seen (and I have seen and made several in my time), have always appeared to have less rise in the floor, and more fulness in the bows and quarters, than the vessels they were designed to represent; but, in drawing, nothing is more easy and simple than a comparison of one drawing with another, whose merits have been ascertained by actual building, as we are able to compare them together, line by line, and see distinctly where and how much they differ, which it is impossible to do with models with any degree of correctness. If there were only this circumstance in its favour, it would decide me in preferring drawing to modelling, as a means of giving instruction to a student in Naval Architecture.

The suggestion of immersing the model in water, in order to ascertain the actual displacement, has been often recommended, and but little practised. Steel, in his "Elements and Practice of Naval Architecture," strongly recommends it. That it may sometimes be of service, I will readily admit; but, in consequence of the difficulty of ascertaining exactly the weight of the actual vessel, it is, after all possible care is taken, only an approximation to the truth. The idea of carefully weighing in the cargo, and marking the depths to which the vessel is immersed, by certain weights, is a much better, because more correct, mode of ascertaining the real burthen of a vessel; and I am informed that it is practised by barge-builders in the river Thames, in order to ascertain the actual capacity of their craft. Were such a system adopted in the mercantile navy of this country, there can be but little doubt but that a great improvement would

soon be seen in the models of our merchant ships, and we should no longer be subject to the ironical remark, that we built our ships by streets, and cut them off as they were wanted.

Nov. 28, 1827. G. B.

HAMMERSMITH SUSPENSION BRIDGE.

Sir,—"A Subscriber" in the "Mechanics' Magazine," No. 224, states, that the principal part of the work for the Hammersmith Bridge was made at the Brierly-hill and the Gospel Oak Works. In No. 222 of the Magazine, you have given the particulars of the iron-work which I had sent to you. I then said that *part* of this iron work had been made at these Works.

"A Subscriber" would insinuate that I have stated that which was not altogether correct.

I shall feel obliged by your inserting, in the next Number of the Magazine, the following, which is the exact quantity of the work made at both these places:—

At Brierly-hill Works.

1534 Common links of 8. 9¾
72 Retaining links 4. 7
16 Retaining bars

1622

At the Gospel Oak Works.

954 Common links, 8. 9¾
126 Links various lengths

2702 pieces, weight rather more than 200 tons.

The links 8 9¾ were made to a pattern sent them by Captain Brown; and the lengths of the others were given by myself, after having *found* the exact length of the chains.

Capt. Brown applied to the Proprietors of those Works, as iron-masters, to supply him with bar-iron, to be sent here to be made into links; but, being pressed as to time, it was agreed that they should be partly finished by them, and sent to London to be tested at Messrs. Brown, Lenox, and Co.'s Works, at Mill Wall; after which, the whole had to be altered and corrected.

Besides the above, the Gospel Oak Works supplied 288 bars for the circular links, &c.; these required to be very correctly finished and fitted for the carriages of the towers: I had them sent here to be made under my own direction.

Though these two Works supplied nearly half the weight of iron for this bridge, they made but three description of articles, viz.

The common links,
The retaining links,
The retaining bars.

All the remainder of the work, as stated in detail, in No. 222 of the "Mechanics' Magazine," and by far the best and most expensive part of the work, was made, and the side plates, circular links, &c. tested, at the Works of Messrs. S. Brown, Lenox, and Co., at this place, under my directions.

I am, Sir,
Your most obedient Servant,
PHILIP THOMAS.

GENERATION OF LINES BY CONTINUOUS MOTION.

Reply of Mr Desvignes to Mr. Jopling.

(Concluded from p. 361.)

The *first* division of my arrangement includes,

Archimedes' method—"a point moving uniformly along a right line, the line at the same time revolving with an uniform angular motion;" effected very probably by his helicon, &c. This principle was invented about 2113 years ago.

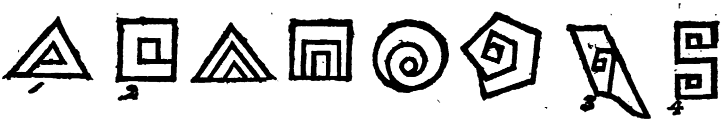
Adam's method, by means of a thread, pulleys, cones, &c.; about 30 years ago.

And all other methods effected by the evolutions of a thread, from any particular base, viz.:

Points or pins placed thus—⁚ or ∴ or ⁚⁚; or in pentagons, hexagons, &c. &c.

Solids (right or oblique), as prisms, pyramids (quadrangular, pentagonal, &c.); cylinders, cones, cylinoids, &c.; involutes, inclined planes similar to frets, and spirals of a pyramidical staircase form;

A vast variety of figures in this class may be easily formed in cork, plaster of Paris, &c.



Figs. 1 and 2 are after Mr. Tredgold's principle.

Fig. 3.—By this, the spiral formed approaches the Erechtheion volutes.

Fig. 4.—By this (and a variety of the same class) may be formed two spirals in contrary directions by one sweep of the pencil—but one of the frets must be somewhat above the other and moveable (either upwards or downwards).

Many kinds of shells may also be used; for example, the Buccina canaliculata of Da Costa (a species of whelks), of which the pyramidical spiral is by nature beautifully formed. The shell requires the aperture only to be ground flat (either in a right or oblique direction), with sealing-wax poured into it, to hold three short pins, whereby the shell may be secured for use. One end of the thread is fixed to a small hole in the shell, and wound tight round the spiral groove; the other end must have a loop to insert the pencil or point: then, by unwinding the thread (extended), at the same time marking with the pencil (as if describing a circle), beautiful spirals may be formed, and varied to a great extent according to the slope, &c. given to the shell, or the number of evolutions made by the thread, &c.* The marker may be made steady, by means of a perforated solid with a flat base.

The *second* division,

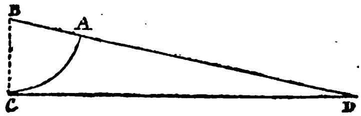
Is on the principle of the rose engine, whereby circular, elliptical, and other spirals, may be formed, at a small expense.

The *third* division,

Is on Suardi's principle, by wheels with cogs. Pulleys are likewise applicable. The perpetual screw, &c.

The *fourth* division,

Contains the tangent and secant of an arc, with the radius chosen at pleasure.



This constitutes the system which I consider original, as my own discovery.* The lines upon which it is founded being out of the question.

The describing point, D, is directed by the intersection of the tangent C D, with the secant B D of the arc A C in motion (on its centre B), generated by the rotator or tan. C D, its centre of motion being at the point of contact C.

The ratios of the ordinates in the spiral will depend on the relation that the diadrom of the arc A C (which may have an equable or variable motion), on its centre B, bears to the diadrom of the municating rotator D C, on its centre C.

This system may be divided into plane and spherical; constituting four grand divisions; viz.

In the 1st, both the tangent and secant are right lines;

In the 2d, the tan. is a right, the sec. is a curved line;

In the 3d, the tan. is a curved, the sec. is a right line;

In the 4th, both the tan. and sec. are curved lines; and each of these divisions may be subdivided according to the nature of the curve—as circular, elliptical, &c., concave or convex as compared with each other.

This principle includes an infinite series of spirals, with many other curves, and can be arranged into a beautiful system of Helicosophy, consisting of two parts; the second thus expressed:—

"The tendency of a point directed by the motion of a line intersecting another line (at rest or in motion), generated by the rotation of a plane, &c. &c., which

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* Or the top of the shell may be filed until a small hole appears (which, when the shell is filled with ink, is to serve as a marker). Then you may proceed by a reverse method; that is, the point must be made stationary, and the shell (guided by the hand) to go round it—at the same time giving the shell an axle motion. This, however, is more difficult to effect (except in very small spirals).

* The tan. sec. sin. cos. &c. of a quadrant, on which all trigonometry is founded, was a discovery (I believe of Pythagoras) now more than 2000 years ago.

will describe circular, elliptical, and other spirals."

I have now in part explained my system, which, in a subsequent letter, I shall explain more fully, and show at the same time how a speiragraph may be constructed by it. In the mean while believe me,

Sir,
Your's respectfully,
PETER HUBERT DESVIGNES.
13, *Hunter-st.Brunswick-sq.*
26th Nov. 1827.

Mr. Jopling's Reply to Mr. Alderson.

Sir,—Any person reading my note (No. 211, page 118) must, I think, perceive that the whole of my charge against Mr. Alderson is, *for stating that his instrument will draw spiral lines, without mentioning, in his report, from whom he got his information.* That this is the fact, both his letter to you, and the last paragraph of his letter to Mr. Aikin, prove.

Had Mr. Alderson contented himself by saying that his instrument would "draw curves of various species," I should have had no occasion to notice either himself or his instrument; but, in that case, he ought, in justice to Mr. Nicholson, to have stated in his report who told him so.

I admit, that before the Committee he "claimed no merit on that score," or on his instrument possessing the property of describing spiral lines; but the memory of the Committee cannot be seen, or read, neither is it so durable a register as the Society's volume.

Besides, he not only states in his report the fact, that his instrument will describe spiral lines, but actually states the method by which *the exact character of the Greek volutes* is to be produced; —viz. by "altering the position of the pen or pencil from the centre;" and as he had introduced these facts into his report, I informed him at the time, in the anteroom of the Society of Arts, that he ought to mention also, *in his report*, who gave him the information. And I was not aware that he had not afterwards done so, until I saw his report, about ten months ago, copied into another work.

The method by which Mr. Alderson has attempted to draw volutes with his instrument, together with the fact of my being able to do so being "yet doubted by many of his friends," and perhaps himself also, only proves that he has not discovered how to *make* USE *of* the information he received from me in any other way besides adding the "*dubious matter*" to his report; and this, in my note, I anticipated.

I might lengthen this letter by comments on his instrument, and on the common-places he has written in attempting to turn the attention of your readers from the simple facts which I alluded to; but I shall only remark—if it be of that importance to be able to describe the Greek volute which Mr. Alderson, with no more than justice, admits that it is, surely I cannot be blamed for noticing, when writing on that subject, any circumstance which might have a tendency, however remote, to remove from myself, or even divide the honour of the discovery with him.

Mr. George Adams, in his Graphic Essays, describes two instruments (figs. 4 and 12, plate X.), invented by J. Preestly, Esq., of Bradford, in Yorkshire, for describing arcs of large circles: these, with engravings of Mr. Nicholson's Cyclograph and Centrolinead, and Mr. Rotcha's Arcograph, it would, I think, be desirable should appear in your Magazine; as they, with Mr. Alderson's instrument, will show the progress that the simple application of the 21st proposition of the third book of Euclid has made.

For the same reason, I think that Mr. Clement's, Mr. Cubitt's, Mr. Farey's, Mr. Lawrie's, Mr. Hart's, and the two instruments for drawing ellipses described in Adams's Essays above alluded to (figs. 2 and 3, plate XI.), should also appear in your pages.*

The lengthened attention bestowed by the several authors on the production of these various instruments, for very limited applications to the principles of two or three cases in more than forty, will show that there is abundant room for mechanical ingenuity in the Septe-

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* It will be seen, from the two preceding passages, that we did Mr. Jopling no more than justice in our last Number, in presuming that he could not be so ignorant of the efforts of those who have preceded him in the same field, as Mr. Desvignes has supposed. The liberal recommendation which he has here given to publish every thing of importance that bears any analogy to his own inventions, must also, we should think, exempt him from the suspicion of seeking any advantage to himself from concealing the merits of others. We shall give all the plans he mentions in regular succession.—EDIT.

nary System; and I should be glad to hear that both Mr. Alderson and Mr. Desvignes continue to exercise theirs; but not by appropriating information received as if it were their own discovery, or by acting as if they were ignorant of the attempts of others.

I am, Sir,
Your obedient Servant,
JOSEPH JOPLING.

24, *Somerset-st., Portman-sq.,*
15 *Dec.* 1827.

Mr. Jopling in answer to Mr. Child, &c.

Sir,—The partial account which I have given of the septenary system, in my two first papers on that subject in your Magazine, having satisfied Mr. Child that I have "undoubtedly carried the thing to a very great extent, and also reduced it to a systematical arrangement," must, I think, prove that that gentleman's claims do not interfere with mine.

That several parts of the system have been long known, I have shown by the short introduction given in the pamphlet. But I have no reason to suppose that, in modern times, any thing like a classification to the extent of the primary principles has before been attempted by any one.

When I have spoken of *thousands* of examples being requisite to illustrate the *septenary system*, it must be kept in mind, that I refer only to the effects, within a limited sphere, of the simple principles. If combinations are to be made (although their effects may be traced to a certain extent), I know not a number sufficiently large to comprehend the variety.

The most simple combinations cannot be clearly understood, until the effects of the first principles are known. All the lines in Mr. C.'s specimens are either in three, four, six, twelve, fifteen, sixteen, or thirty parts, respectively symmetrical; and if one portion, as one third, one fourth, &c. of any line be marked, it will contain all the variation of curvature in that figure. Thus, it will appear, the variation of curvature is not more than what might be shown by far more simple figures, which only require to be repeated the given number of times to produce any of those complicated examples. For ornamental turning, such combinations of principles as Mr. Child's and Mr. Ibbetson's are certainly applicable; but they would be of no service in describing the arch of Waterloo Bridge, or for drawing gothic arches of the largest dimensions, or for producing gradations of curves between any two selected forms, for the construction of any solid, or for the purposes of naval architecture, &c. &c.

Mr. Ibbetson, I believe, founds his chuck on the principles of Suardi's, or the Geometric pen; (these principles form one division of my system); but Mr. Child has not stated whether his ideas were entirely original.

In Mr. Child's first letter, he speaks of *parallel ellipses*, and, perhaps, most persons who have only drawn such lines to a small scale have imagined the same thing; but a line parallel to an ellipse, is not an ellipse. A line parallel to an elliptical line may have loops or nodes.

Mr. Child supposes I have stated that few persons could use an instrument for drawing volutes, if they possessed one. In this he misunderstood me, for any person may be instructed to use one of mine.

I am not quite certain whether I understand what Mr. C. says respecting a method made use of by him for drawing spirals; but the accompanying observations on the Greek volutes will enable him to judge whether the lines he has produced have that character; or, if not, he can make use of the same means to show the character of the lines he can draw.

Should you insert descriptions of the elliptical instruments I have enumerated in a former letter, Mr. C. will find amongst them what he inquires for in his *note*.

The gratification experienced by Mr. Child, in perusing my papers, was not, I can assure him, greater than I felt when reading his last, to me, most interesting letter and testimonial.

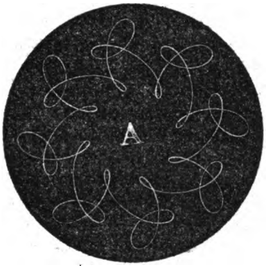
I am, Sir,
JOS. JOPLING.

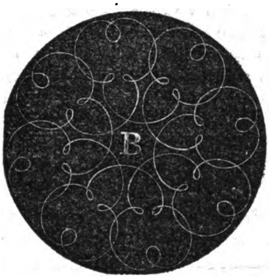
[Mr. Jopling's Observations on the Greek Volutes we must reserve till our next.—EDIT.]

Mr. Ibbetson, in answer to Mr. Child, &c.

Sir,—I have perused Mr. Child's communication, which appeared in the Mechanics' Magazine of last Saturday, wherein he informs me that he "is in possession of a model of an apparatus which may be made to produce any of the figures I have offered to the attention of your readers; and, as he humbly conceives, a great variety of others, much more intricate."

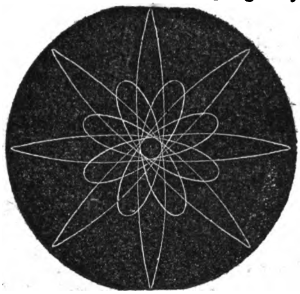
In answer to this, I herewith send you four engravings, which I executed on Monday morning last, by means of my geometric chuck. Two of these, marked A and B,

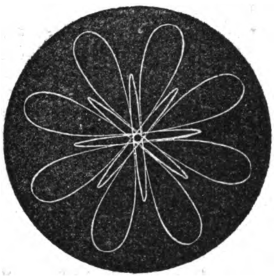




are similar to two of the figures given by Mr. Child as specimens of the performance of his apparatus; and thus, I apprehend, I prove, in a more satisfactory manner than *by assertion*, the power of my chuck, not only of *originating figures*, *but of copying what others do;* and I have no hesitation in pledging myself, that for every specimen he may send you for insertion in your publication, I will send you two, which shall be equally or more intricate. The insertion of what I shall send will occasion you neither trouble nor expense, as I will present you with the engravings fit for the press.

The other two engravings I now send you are of a much more complicated nature than either A or B. They each consist of one uninterrupted line; and the motion of the plane against a fixed point, by which they are generated, is of such a nature, as, alternately, to produce the round and sharp extremities of the curves. I have proved, by the engravings A and B, that I fully comprehend the nature of the curves which constitute Mr. Child's specimens; and I beg to inform him, that if the combination of movements given to his apparatus does not go beyond the production of such curves, the power of the geometric chuck very greatly exceeds it: and I will here further observe, that the curves exhibited by the last two engravings cannot be produced under Mr. Jopling's system.





I beg to submit to your inspection a large collection of engravings, which I have executed with my chuck; and I have placed in the hands of Mr. Stewart, ivory turner, in Oxford-street, near the Pantheon, a similar set of specimens, and he will exhibit them to any one who will take the trouble of applying to him.

In my communication, inserted in the Mechanics' Magazine of the 21st July last (No. 204, p. 15), I gave a specimen of the power which my chuck possesses of dividing the *periphery of an ellipsis into any number of equal parts;* and I stated that I had every reason to consider that this power was quite new. Now, Sir, Mr. Child is pleased to inform and assure me, that I am quite mistaken, and that figures, depending on this power, are at least forty years old; for, that he, at that distant period, made a model of an apparatus that would do the same thing. It is by no means, however, my intention to enter into any controversy with Mr. Child on this point. I know nothing whatever of what he may have done; and I am not aware that he has ever, until now, made any communication of what he could do. It is quite clear, therefore, that I, at least, have borrowed nothing from his exertions;

and I think he will, in common candour, admit that what he has now said, for the purpose of depreciating mine, entitles me to ask him to send, for insertion in your publication, a copy of the specimen which appears in No. 204, or some pattern or other, to prove that his apparatus possesses this power, which fact is not established by any one of the specimens exhibited in the Mechanics' Magazine of last Saturday; but quite the contrary, as not one of these curves partake of the motion, or movement, requisite to the division of the periphery of the ellipsis into equal parts.

I am, Sir,
Your very obedient Servant,
JOHN HOLT IBBETSON.

P. S. I can refer Mr. Child to some friends of mine, who are resident in his part of the country, and have seen my geometric chuck work, viz.—Mr. Wilkinson, of Elmwood House, near Leeds; Mr. Mottey, of Osborn Thorpe House, near Leeds; and Mr. Muff, of Leeds—either of whom will, I am sure, afford him ample testimony.

FIRE PREVENTION—INQUIRY ANSWERED.

Sir,—In reply to the inquiry of "A Constant Reader," in No. 225, I would recommend him, as the most economical method he can adopt, to have a cistern erected on the roof of the building to which he alludes. From this cistern a pipe should descend to the lowest part of the building, furnished with a cock and screw in each floor; to any of which a hose and branch could be attached in case of fire. The cistern to be filled by a *good lifting pump*, either in or adjoining the premises. This arrangement would answer the purpose of a fire-engine, at about one-fourth of the expense; for as water will always find its level, if placed on the roof of the building, all parts of it will be within its reach. In case of fire, it would be advisable to put the pump in action, to maintain a supply in the elevated cistern.

Before any thing like an estimate could be given, it would be necessary to know the height, and other dimensions, of the building; but, if the above plan be approved of, any neighbouring plumber will readily furnish the estimate. To secure the roof from *external* danger, the composition of your correspondent "S." (page 208), might be applied with advantage.

While I have my pen in hand, I cannot avoid noticing the long and *still accumulating* lists of unanswered inquiries, which are to be found *reposing* in the pages of the Mechanics' Magazine. I am well aware that some of the inquiries are beyond the reach of general observation, but there are many, very many, which I cannot help thinking it is in the power of some of your readers to elucidate; and, by their so doing, they will not only gratify the original inquirers, but also many of your numerous readers, and none more than,

Your obedient Servant,
W. BADDELEY, JUN.

10, *George Yard, Lombard St.*
Dec. 17, 1827.

NOTICES TO CORRESPONDENTS.

The present Number has, on account of the holidays, been put to press earlier than usual, and been made up without reference to any letters received later than Thursday last, the 20th December.

"Tamesis" is mistaken in supposing that the paragraph which has gone the round of the Papers, respecting the abandonment of the Thames Tunnel, had its origin in our strictures upon it. *We* never said that it would be abandoned; but, on the contrary, that it would be completed by means of a loan—which turns out to be the fact. The question, however, still remains to be answered—Why was any loan necessary?

Communications received from T. M.—B.—P.—F. G 4.—Nicodemus.—S. F. G.—Ignis—H. L.—W. Sommerville.—A First Subscriber.—B. R. S.—Index.—G. le D.—J. Brown.—Uidunus.—S. M. E. B.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 228.] **SATURDAY, JANUARY 5, 1828.** **[Price 3*d.***

EVANS'S PATENT STILL.

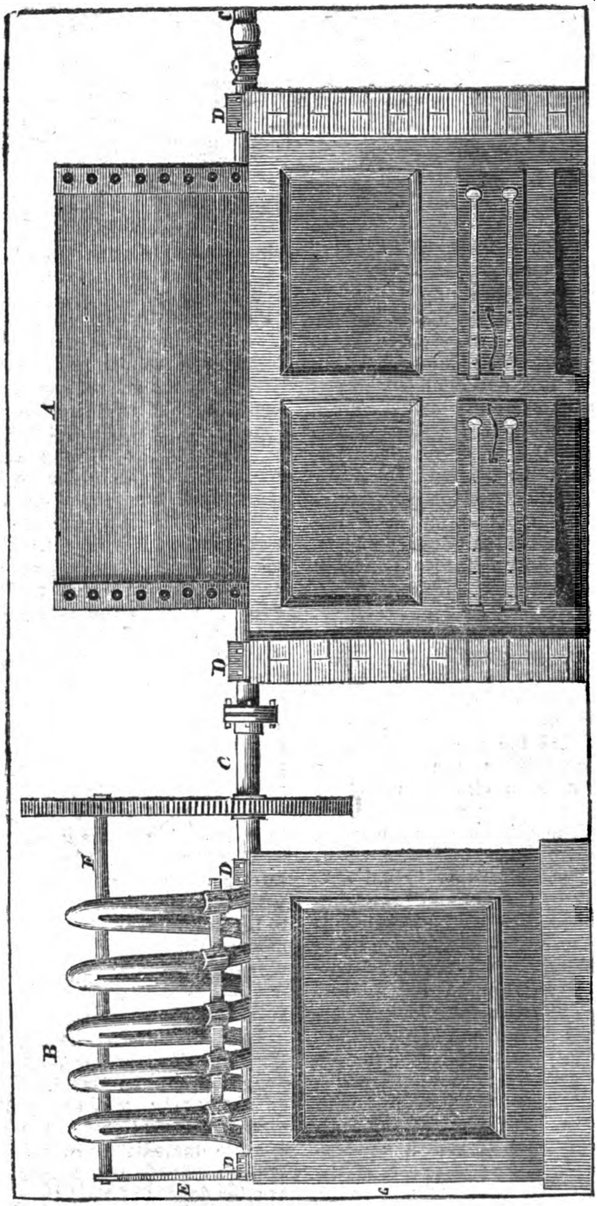


Fig. 1.

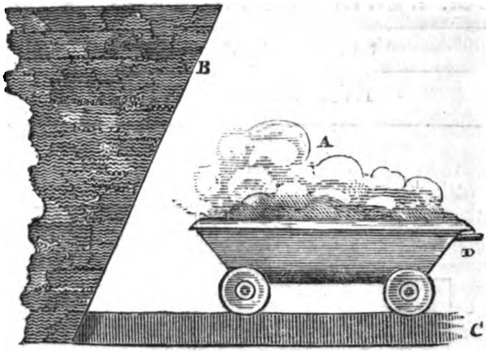


Fig. 2.

EVANS'S IMPROVED PATENT STILL.

(From a Correspondent.)

In laying this highly ingenious and excellent improvement on the old still before our readers, it is necessary for their information to state, that it is not required, in the explanation of its mode of working, that various adjuncts, such as the wash-charger, reservoir, refrigerator, &c., should be shown, as many portable and economical substitutes may be made to answer (according to circumstances) the desired effects. Reserving, for a future paper, a more lengthened description of Mr. Evans's inventions, we shall content ourselves for the present with describing the more novel parts of the machine before us.

On the right of fig. 1, *(not shown)* supported on brickwork, is placed a vat called the wash-charger, or vessel containing the fermented liquor. A is a circular vessel or cylinder, revolving upon a hollow shaft C C, which conveys the wash, by means of cocks, from the wash-charger to the still or cylinder A. This still, by the action of a steam engine, or other motive power, is made to revolve over a furnace; and after a short period, the alcohol or spirit, passes through the hollow tube C on this side, into the worm, or coiled pipe B, termed the rectifier, which also revolves (in conjunction with the still A). The vessel, which contains the *rectifier*, is filled with water to a certain height and temperature, which causes a condensation of the more gross parts of the liquor to take place, and allows the pure alcohol to pass into the refrigerator, which is of the common form: and thence to the reservoir for the reception of the newly-formed spirit. The peculiar form of the rectifier, together with its rotary motion, causes the residue, or condensed liquor *in the rectifier*, to be conveyed back into the still, thus acting in the manner of the screw of Archimedes. In order to agitate the wash in the still, there are projecting horizontal shelves on its sides to effect this object. D D D D are bearings for the shafts; E stand and bearer for shaft and wheel F, connected to the steam engine; G vessel containing rectifier.

Fig. 2. B is the side elevation of the brickwork for the furnace, and over which the still is placed; A is a moveable furnace upon wheels, and running upon the rail C, for the purpose of removing the fire during the recharging the still; D is the handle or eye for moving it backward or forward. Near the wash-charger, and on the hollow shaft C, is fixed an air-pump of small dimensions; which, by means of a pipe attached to the hollow shaft C, and descending near to the bottom of the still, enables the operator to draw off, in a few minutes, all that remains in the still after the process of distillation.

It will be perceived that, by this ingenious process, an equable degree of heat is given to *the whole of the wash:* not so by the old method; as that part of the alembic fixed in immediate contact with the fire, was necessarily subjected to a greater degree of heat than the up-

permost part; and, as a consequence, an empyreumatic oil was formed, highly injurious to the article; which, by this mode, is obviated, and spirit of the greatest strength is distilled at *one process!*

OBSERVATIONS ON THE SPIRAL LINES OF THE GREEK VOLUTES, BY MR. JOPLING.

The method which has been adopted by *Stuart* and others, in taking the dimensions of *volutes*, is to measure on right lines in four directions, passing through the eye or centre. These lines, making angles of 45 degrees with each other, are called vertical, horizontal, and diagonal, and divide the volute or spiral into eight parts. By this means, nine points (including the first and last) in each revolution of the volute are obtained. Now, if the distances of each of these points, from the centre of the eye in any one revolution, be set off upon a right line, they will form a scale by which the character of the variation of curvature in each 45 degrees may be distinctly observed; and had this method been adopted by our *travellers*, they might have corrected, on the spot, any inaccuracy they inadvertently may have made.

The accompanying scales (fig. 1) show the laws of variation in several Greek examples.

The end of the scales, marked C, is the centre of the eye of the volutes. The end A is the greatest, and B, or the mark nearest to C, the least, distance in one revolution; and the intermediate gradations on each line show the distances from the centre of the eye, at every 45 degrees in the several examples.

Fig. 2 will exhibit the method more clearly. The corresponding letters, and numerical figures, show the directions of the lines, &c., to which the different distances from the centre C refers.

In the examples I have measured, I took the distances at every 22½ degrees, or double the number of points given by Stuart, &c.: by doing so, any inaccuracy was instantly detected. But in the scales, in order to compare them with the others, the points at every 45 degrees only are marked.

As all the dimensions necessary for forming these scales correctly are not given by *Stuart*, I formed those scales which are distinguished by his name, from the engravings in his work; but as far as I could go with the dimensions, I found the same general character prevail.

The scale No. 3 is formed from dimensions which Mr. Thomas L. Donaldson had the kindness to permit me to take from a cast in his possession.

For this, and for taking the dimensions for the scale, No. 6, of the example in the Gallery of Antiquities in the British Museum, I adopted the following method:—Having cut out a piece of paper like the *radiated openings* of a ventilator, I placed it against the volute, (the centre of the paper corresponding with the centre of the eye,) and then marked on the edges of the openings the several points in the largest complete revolution I could obtain.

It will appear, from scales No. 1 to 7, that although they are not alike, yet there is so much of the same character of variation in each, as to make it quite evident that they have all been generated by similar methods. Indeed, their differences may be all accounted for, by the differences of their whole rates of variation in 360 degrees, and in the selection of different points in the spiral lines for the top of the volutes; if but a very moderate allowance be made for the inaccuracies of the ancient artists, or in taking the dimensions from such mutilated examples.

Although there is a constant variation of curvature in the Greek spirals, the variation is not uniform; therefore, the rule which Mr. Inwood has given, in his recent publication, for obtaining points in the line of the outer edge, which had been broken away, of the volute of the *Temple of Victory*, and which he says "is perfectly simple of adoption on all occasions, for the common purposes of drawing, or in the workmen executing any spiral," has not the Greek character!!

By comparing scale No. 8, which is formed from the drawing in Mr. Inwood's work, with the others, this will appear manifest.

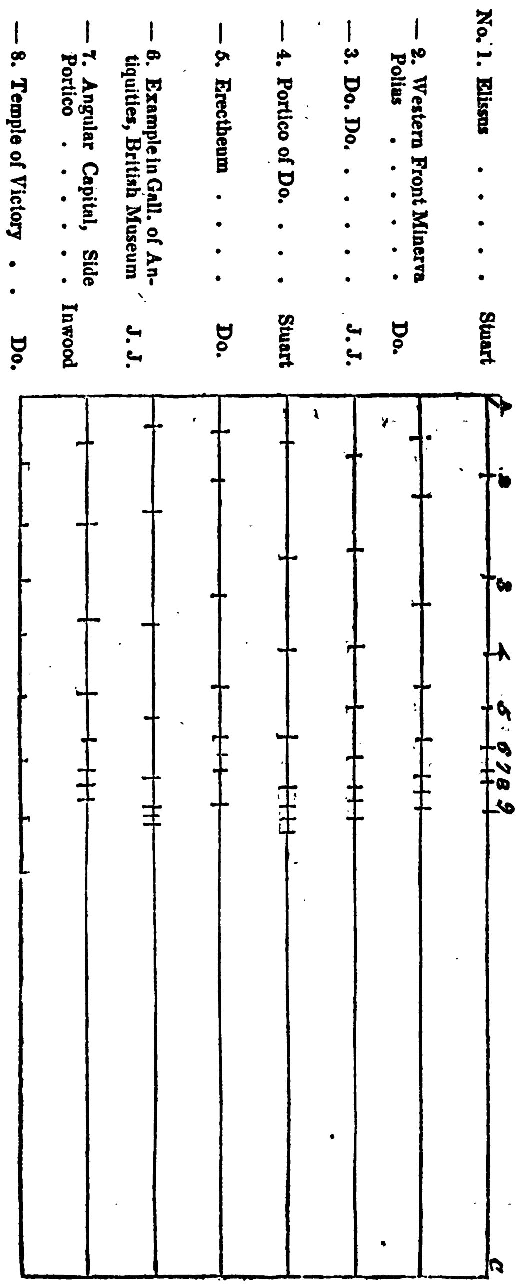
It has been supposed, that the form of volutes has been taken from shells; it will, in order to prove that supposition, now be necessary to show that the shells from which such forms have been taken, have the Greek spiral character.

I by no means wish it to be supposed that, in every point, the accompanying scales are correct to the twentieth or even tenth part of an inch. All that I attempt, in the present instance, is to point out that there is such a general law of variation in the Greek volutes; and to say that one of my instruments produces spirals with the same general

character, and that it possesses an indefinite power of variation.

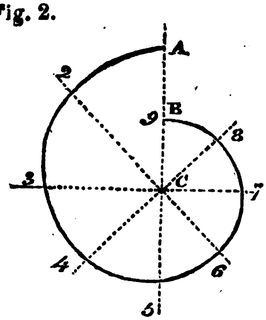
Perhaps it is not unreasonable to suppose, that the Greeks were acquainted

Fig. 1.



with the principles of the common trammel; and if so, there is no reason,

Fig. 2.



I think, to imagine they were not acquainted with its reverse; unless, indeed, it be that so beautiful a figure as the cuspidated cardioid never appears, to my knowledge, in any ancient works. They might, however, have known the one without knowing the other.

As Mr. Inwood is said to have visited Greece, that Pancras New Church might be correctly executed, it would be interesting to know whether the volutes of that building have the Greek character, or whether they have been executed by the rule which he has given, and which I think I have proved has not.

Perhaps some of your readers could furnish other scales of ancient examples.

Hoping that this information may prove interesting to your readers,

I am, Sir,
Your obedient Servant,
Jos. Jopling.

REPLY OF MR. JOPLING TO MR. DESVIGNES.

Sir,—That any method of describing the Ionic volute, otherwise than by approximation, was unknown previous to mine, or at least unpublished, in this country, the various approximate methods alluded to in our numerous works on architecture, I think, satisfactorily show.

That I had discovered one method (and I could prove it was not the only one by many), and also the Septenary System, previously to explaining them to Mr. Desvignes, is, I think, quite manifest by his own letter.

And that M. Desvignes (notwithstanding his father's rose-engine having been in his possession several years) never had any idea of constructing an instrument for drawing spirals until after he had seen my instruments, I think could be satisfactorily proved by his friend, Mr. Watson.

Therefore, as far as concerns Mr. D. and myself, your readers will, I am convinced, allow that I am entitled to the precedency, in having invented "a new long sought-for instrument;" and one, too, that describes volutes with the exact Greek character, and applicable to *engraving* as well as drawing.

Mr. D. has yet to prove the volutes that he has drawn have the *Greek character*, and which, no doubt, he is anxious they should have; for he can have no desire to charge the ancient artists, his countrymen, with a want of accuracy.

The whole of the four divisions (as Mr. D. calls them), the principles of which he has used in drawing spirals, are included in my *third* general statement (No. 220, p. 262), and also in my System, which he admits I explained to him.

He certainly states that his *four divisions* comprise a *few* of the principles; but why he has stated these *few*, I know not—surely, not that it should be supposed that he has made use of those principles in the construction of his *Speiragraph?* for, in a letter to me, he says, "*the principle upon which my instrument is constructed bears not the slightest resemblance to yours; indeed, the* MOTION *does not* EVEN *enter into any of* YOUR CATEGORIES."

Now, it was entirely in consequence of this assertion that I was induced to lay the matter before your readers; for I could not persuade myself that he was so unacquainted with what I had explained to him, as not to know what my *categories* (as he was pleased to call them) were; neither could I persuade myself that it was possible for him, or any other person, to make an instrument of "simple construction" for drawing volutes, without making use of one or other of the principles of my system.

He certainly may have combined these principles in a way that may not have occurred to me—for there is no limit to combinations; but if so, his instrument is not of "simple construction," as he states it is, in his circular notice, which I enclose,* and which he sent to me in

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* The following is the circular referred to:—

"*Speiragraph—a new (long sought for) Instrument.*—To the admirers of the beautiful curves of the Greek and Roman ornaments of embellishment, and to the Profession, Mr. PETER H. DESVIGNES, Architect (late Pupil to William Atkinson, Esq., Architect to the Ordnance Depart-

the letter from which I have quoted, which was in answer to one I had written to him after I had been informed of his proceeding by Mr. Inwood, *who considered Mr. D. had got the start of me.*

It will be seen by my letters, in reply to Mr. Alderson and Mr. Child, that I was not unacquainted with Suardi's pen, and other instruments described by Adams. What Mr. D.'s rose-engine is, I know not, although Mr. D. sen. repeatedly *talked* about letting me see it: I believe it was only talk; for I have no reason to suppose that either he or his son ever intended I should see it.

Mr. Desvignes is either very ignorant of what I mean by the Septenary System, or wilfully so; otherwise, he could not have supposed that any thing he has advanced could in the least affect the originality of my inventions.

Before he can prove that my system is not original, he must first show that some one before me has formed a classication of all the primary principles in the order of gradual connexion; and he must also point out all the cases of *simple* motion in his rose-engine, before I will believe that it includes the whole of the Septenary System.

I enumerate more than fifty cases, as I have already stated, of *simple motion;* and if but one connecting link were wanting, the system would not be perfect. Of these cases of simple motion, I have certainly never seen, in any of all the works I have consulted, more than one half; and I have never seen more than the principles of three divisions applied to regulate the movement of a *plane.*

Without a complete illustration, I find it difficult, as EVERY CASE may be varied *ad infinitum,* to make the gradual connexion and harmony of the whole appear sufficiently obvious. This sort of discussion, I trust, however, will be of some use in this respect.

The advances I have made in the art of generating curves, have been compared to the addition of the cypher in arithmetic. The first instrument I exhibited will describe lines in at least thirty cases, and there is not a single wheel in its construction. When principles are known, combinations are easily made; but I can assure you, that the discovery and arrangement of the several simple motions was not an easy task.

I could put and prove a very different aspect on the introductory portion of Mr. Desvignes' letter, but I think it unworthy of notice; all I need say is, that his attempt to justify his conduct has been by unjustly endeavouring to make it appear, that I have acted like himself. The introduction to my pamphlet, which, if you choose, you can copy, will show, that as far as I then knew, I enumerated various curves that could be described by continued motion, and the authors of instruments for generating them.*

I am, Sir,
Yours, &c.
J. JOPLING.

P.S. Should it be necessary, I will also reply to the remainder of Mr. D.'s letter; but, as it is probable I may be out of town soon, I have thought it better not to wait for it.

POTATO ESSENCE.

Sir,—The term *flour* having been applied to the fecula of potatoes, has caused great confusion in the minds of several persons with whom I have conversed, and appears to be one source of the disappointment complained of by your correspondent X. X. in your 223d Number.

Flour is obtained from various farinaceous grains, by the well-known process of grinding, and consists (as X. X. will see by referring to No. 213) of starch, gluten, sugar, gum, and albumen; and, as Mr. Goulson there justly observes, "without a due proportion of the

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* The following is Mr. Jopling's Introduction. It had escaped our recollection when we penned the note on page 361; otherwise we need not have put it as a matter of reasonable supposition merely, that Mr. J. was perfectly

men, M.G.S., F.H.S., &c.) takes leave to state, that very shortly he will produce an Instrument (of simple construction) by which ANY * of the spiral lines shall be almost instantaneously described, with the utmost facility and with astonishing exactness, the whole of the curve being performed in one continued line. †

13, *Hunter-street, Brunswick-square, Aug.* 13, 1827."

* Parabolic, logarithmic, Archimedian, Tredgolian, Erecthean, &c. &c.; and soon one to describe elliptical volutes.

† Meaning, that if it were required to describe 50 or more revolutions, this instrument is set but once, and never leaves off until the required revolutions are completed in ink or pencil.

three first constituents, bread cannot be formed;" but, containing these, it possesses the property of forming, with water and yeast, a tough spongy substance—dough; which, by proper attention to the fermentation, and management in the baking, may be ultimately converted into good wholesome bread: this, then, is what is universally known in this country by the name of flour.

The white powder obtainable from potatoes, by a process I am about to describe, consists of only one of those substances—namely, starch, which will not form dough with water and yeast; neither is it possible to make it undergo the panary fermentation; it is perfectly insoluble in cold water, but soluble in that fluid at a boiling temperature, with which it forms a semi-transparent mucilage; if this be dried, it is converted into a stiff hard

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acquainted with the history of his favourite pursuit. We can imagine nothing more candid or satisfactory.

"*Introduction.*

"The following is a brief account of those curves that can be generated by *continued motion*, modes of doing which have been invented by other persons in different ages.

Names of the Curves.	*Years since first known.*	*By whom discovered.*	*Conjectures and Observations.*
Cardioid	118	M. Carré.	
Circle	—	—	The method of generating a circle, from a pole or centre, is, no doubt, of the greatest antiquity. The other methods, on the principle of generating the ellipses, and on that of the twenty-first proposition of the third book of Euclid, are probably of a recent date.
Cissoid	1400	Deroche	
Conchoid....	2000	Nicomedes	
Cycloid	about 400	—	The exact time of its discovery, and consequently by whom, not agreed.
Ellipsis	—	—	Probably the method of generating an ellipsis, by a trammel, is of an ancient date. Other methods are, perhaps, of a more recent date.
Epicycloid ..	—	—	Probably discovered at the same time as the cycloid. The principles seem to have been first reduced to practice by J. B. Suardi, inventor of the geometric pen.
Oval........	25	Mr. P. Nicholson	He invented, about the same time, methods of generating two kinds of ovals.
—	—	—	The curve of the ninth question of the 'Ladies' Diary' of the present year is without a name.

"These are all that the author has met with; and the whole are comprehended in the Septenary Scale; but should any gentleman, whose learning and opportunities are calculated for such a work, be induced to enter into the research, a more enlarged account, no doubt, may be obtained."

mass, and is still insoluble in cold, but soluble in boiling water.

X. X. will perceive, then, that wheaten flour and the fecula of potatoes are as different in their properties, and distinct in their nature, as a pair of milk-pails and a sign-post.

The most simple method of preparing this substance in the small way, is to provide a large grater (a piece of sheet iron, about 8 inches wide and 10 long, cut full of holes with a chisel, so as to raise a high burr, then bent into a half round, and nailed to a board, answers the purpose excellently), and a large dish or other vessel, with a quantity of water. After the potatoes are well washed, they must be rasped into the water, and, as the pulp collects, it is to be thrown on a sieve placed over a tub, and well washed, by repeatedly pouring water and rubbing it about with the hand; after this is done, it may be left to subside until the powder is completely settled to the bottom, when the water must be poured gently off; and if the starch does not look very white, another portion of clean water may be poured on, well stirred, and again left to subside: after it is thoroughly washed, and the water finally poured off as closely as possible, it must be dried at a temperature not exceeding 90° F.

This is the easiest plan, where only a small quantity is wanted; but for preparing it in a large way, various methods have been proposed; but as I have not tried any myself, I cannot recommend one in preference to the others. Perhaps some of your ingenious readers may be able to furnish a sketch of a machine that has been tried and found to answer.

By the above process, a fine white fecula is obtained, which, were it introduced, would be a useful auxiliary as food for persons of delicate constitution, and children in poor families, where more expensive sorts of light dainties cannot be purchased; but it would be impossible for a labouring man to live on it, as has been recommended. It does not furnish the digestive organs with sufficient matter to act on to keep them in a vigorous state. I have frequently taken it, and always find myself perfectly satisfied for a short time, after eating about a pint. It is of such a thickening nature, that all the solid substance a person in good health can take at one meal is contained in a table-spoon. What think you, Mr. Editor, of a strong man in good health to go pile-driving or ballast-heaving four or five hours, upon the strength of this said table-spoonful? *I* think he would be glad to return to his old diet, if it were only bread and cheese, with a pint of Barclay and Perkins' Entire to wash it down. Half what has been said, and three-fourths of what has been written, on potato-flour, as they call it, is humbug, depend on it, Mr. Editor.

Yours respectfully,

J. ALWIN.

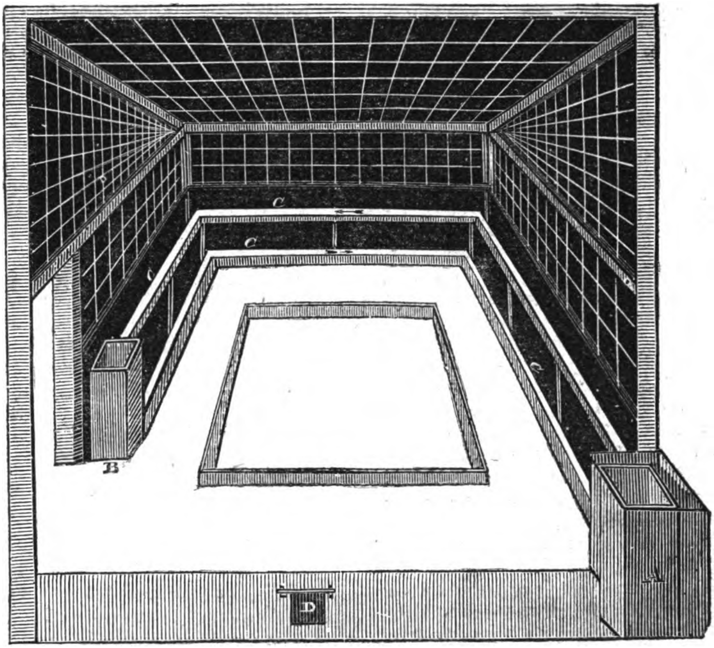
Woolwich, Dec. 9, 1827.

IMPROVEMENT IN THE SYSTEM OF WARMING BY HOT WATER.

Sir,—In your 225th Number, you have extracted from the "Gardener's Magazine" an account of a new system of heating conservatories, &c. Being strongly impressed with the force of the learned Mr. Boyle's observation, "that if every artizan would but communicate what observations occurred to him in the exercise of his trade, the advantage would be incalculable," I had prepared for the "Mechanics' Magazine," previous to receiving Number 225, the following design for an improvement on this new system. Many of your readers, who had seen the account in the "Gardener's Magazine," were of opinion that the pipes would be liable to be stopped up by the deposition of the earthy matters contained in the hot water; pipes used for similar purposes having been found to get very soon furred. To remove this obstacle to the general adoption of the very superior plan of heating by water, is the object of the improvement I have now to suggest.

The following drawing exhibits the interior of a conservatory heated

in the new manner. A is the boiler: B the reservoir: CCCC the conductors of the water to and fro; these are *not round*, but square, and put together on the same principle as the ship-builders' stoves: D



is a section of these conductors, from which it will be seen that they are cast in two pieces, and put together with small bolts; so that the sediment may, from time to time, be easily removed from the inside.

In all other respects, the mode of heating should be the same as tha described in No. 225.

I am, Sir,
Yours, &c.
M. SAUL.

Sulyard-street, Lancaster,
Dec. 20, 1827.

ON GEOMETRIC PROPORTIONS.

Sir,—The following is the substance of an old French story:—A certain person calling on a simple acquaintance of his, the conversation happened to turn on the price of wine, when the former said, that he wished to purchase a small quantity of some particular wine, and the latter replying that he had various sorts to dispose of, they repaired to the cellar, where the intended purchaser made choice of two small casks of ten gallons each, but observed that it would be inconvenient to him to take the TWO casks, and therefore wished to have the same quantity delivered in *one cask.* "I have not a cask in my cellar of such a size," returned Monsieur Simpleton; "however, my cooper can soon take these *two ten gallon casks*, and after *unstaving* them, can put them together so as to form *one cask* out of the staves of the *two* ten gallon vessels!" "A very good idea! a capital plan!" said the knowing purchaser; "it's a bargain, by Bacchus! is it not, *mon ami?*" "*Oh, oui, oui, sans doute!*" The cooper set to work, and the two casks were accordingly converted into one; but, on proceeding to fill it, the poor wine seller found himself grievously mistaken, for instead of twenty gallons being sufficient to fill the new formed cask, he soon

found it would contain a much greater quantity. The history then relates that they went to law upon the subject; the purchaser contending he had a right to his bargain, and the simple wine merchant denouncing vengeance against his antagonist and the cooper, for being such consummate scoundrels as to make a couple of ten gallon casks hold a supernaturally greater quantity than they ought to do. The sequel of our faithful narrative relateth, that after much eloquence displayed on both sides, the lawyers eased their happy clients, by taking both casks and wine in part payment of their fees.*

What, however, I wish to ask is this:—What is the increase of capacity arising from such a transmutation (if I may so express myself) of two casks into one; and how shall we proceed in endeavouring scientifically to determine the said increase, whatever may be the size of the two vessels which are to be thrown into one? I imagine that a simple way of proving that the capacity of any cask thus formed from the identical staves of two smaller ones IS much larger than the two when separate, may be found by taking a couple of round white card or pasteboard pill-boxes, of that neat kind which all our most respectable chemists and druggists use. Choose them as nearly alike, in every way, as you can; throw aside the tops, and consider the two boxes as two casks or tubs of equal dimensions: now, then, push out the bottom piece of pasteboard of each, and you will have two cylinders of equal dimensions. By a clear straight cut of a penknife from top to bottom, open each cylinder thus, fig. 1,

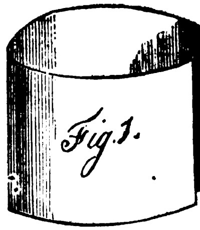
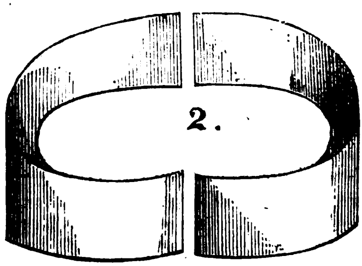


Fig. 1.


2.

and then stretch them out into two semicircles, (as above fig. 2). Any one who understands what I mean, will be able to cut out, by the help of a pair of compasses and his own ingenuity, a new and larger bottom of pasteboard for the two boxes or cylinders thus to be joined into one. A band of paper pasted round them will keep them together. A third box of the *same size* as either of the two first provided, being filled with any powdered substance, and then twice emptied into the larger box formed of the two put together, it will be seen how much the latter is increased.

I am, Sir,
Your's, &c.
F. B.

P. S. I forgot to say that I have a perfect *horror* of algebra; so, for mercy's sake, let any solution of the

* An instance of the same sort of ignorance, fully as amusing, and certainly *more authentic*, was furnished by the well known Mr. Frederick Accum, when examined before the House of Commons on the first application, in 1809, of the Chartered Gas Light and Coke Company, for a Bill of Incorporation. To the astonishment of every person present who had crossed the *Pons Asinorum*, he affirmed that the solid content of a flame of two inches diameter, was only double that of a flame one inch in diameter. Nor was this an inadvertent blunder; for, on being cross-examined by Mr. Brougham, he persisted stoutly in the correctness of his calculation! Another Member asked, whether he meant to assert, that the area of a circle, whose diameter was twice that of another circle, was only double the area of that circle, he replied with exquisite self-complacency, "Sir, *my* opinion is that it is double; *your* opinion may be that it is four times; but mine is that it is *double!!!*"—Edit.

above be written in plain English. None of your Abracadabra for me;—your plus, a good appetite; minus, a beef steak, &c. &c.

BOOKS ON GAS LIGHTING.

An opinion which we expressed in our 223d Number, that "all the works which have hitherto appeared on this subject (Gas Lighting) have had a disgraceful intermixture of quackery and false pretension," has produced a letter of remonstrance and complaint from Mr. Peckston, the author of a book entitled (we believe) "The Theory and Practice of Gas Lighting," published some eight or nine years ago. Every word of that letter which concerns Mr. P.'s own vindication we shall now subjoin (only following in this our uniform practice when individuals conceive themselves aggrieved by any thing that appears in our pages); but two or three paragraphs of it we shall leave out, because they do not concern Mr. P.'s merits at all, but consist of a review of our review of Mr. Matthews's "Compendium of Gas Lighting"—a sort of discussion contrary to all the usages of criticism, and not, at all events, to be entertained at the instance of one whose object is to contest the praise bestowed on a rival.

Perhaps the opinion we expressed was too absolute and unqualified; for, as it stands, it would seem to imply that we thought every thing that has appeared on the subject of Gas Lighting has been disfigured by quackery and pretension—a judgment that would include in its censure several honorable exceptions—some papers particularly by Henry, Henry, Dalton, Leslie, Herapath, &c.; and to which no honest critic can refuse the praise both of great ability and of perfect impartiality. That opinion, however, such as it is, was not pronounced either in ignorance of any of the various works that have been written on Gas Lighting, or without due reflection on their merits. It expressed, in a few words, the general and fixed impression of our minds, that in no one branch of scientific inquiry has the progress of truth been more crossed and retarded for the sake of private ends, and by means of downright trick and charlatanism, than this of Gas Lighting. Need we call to recollection the monstrous puffs of Mr. Winsor? or the more artful quackery of Frederick Accum? or the gunpowder Reports of ——— ? or the *oily* periods of —— and ——? or the exploits of any other of the numerous individuals who, in this money-seeking, contract-hunting, company-forming age, have made choice of Gas Lighting as a theatre for the display of their ingenuity and address? *To write a book* (no matter how) upon some particular branch of practice, has been long considered, among medical men, as one of the surest passports to employment; a calculation of the same kind has, undoubtedly, made more than one would-be-gas-lighter an author. It is certain, at least, that not to those who have written and talked most about Gas Lighting, is it most indebted for the high state of perfection which it has attained. The names of Murdoch and Clegg will be remembered, in connexion with this important art, long after all the mere makers of books concerning it have sunk into utter oblivion.

How far we think the work of Mr. Peckston entitled to a place among the exceptions to the character we have given of books on Gas Lighting, we do not feel ourselves particularly called upon to say. We have confessed, that in the universality of our condemnation, we have erred, and do not conceive that it is at all incumbent upon us to answer the challenge of every individual who may insist on knowing whether we include him in it or not. We would merely observe, in reference to what Mr. Peckston says of the favourable criticisms which have been given of his work, that we have a perfect recollection of some that were of a very different complexion. Of the justice of these last, we of course say nothing.

Mr. Peckston's Letter.

Sir,—On looking over No. 223 of your valuable Magazine, a few days ago, I was greatly surprised (at the head of a paper, page 306, purporting to be extracted from "An Historical Sketch of the Origin, Progress, and Present State of Gas Lighting, by William Matthews") to find some observations which are so "*fact perverting*," as to require immediate explanation.

You say—"All the works which have hitherto appeared on this subject have had a disgraceful intermixture of quackery and false pretensions; we can safely recommend the present, as distinguished by great candour, honesty, and impartiality."

Now, Sir, I conceive this to be a serious charge made against those who have heretofore written on "Gas Lighting." As I happen to be one of those individuals, and my work has stood the test of upwards of eight years, and gone through two editions, free from such an attack, I conceive your talents must be of a very superior order to have *now* found out that my work (which, of course, is included in the sweeping word *all)* is deserving of the epithets you are pleased to use.

People there are who differ widely in opinion with you; and, amongst these, I may mention Professor Brande and Leslie, Dr. Ure, and many others of extensive practice and great experience in the manufacture of gas on a large scale. As I happen to have had twelve years' experience in the details of this new science (upwards of three years reporting upon all the experiments made for the production and purification of gas, and the action of new machinery, at the largest establishment in the world; and, for nine more, either in giving plans and superintending the erection of gas works, or as a contractor for erecting such works in this country and in Ireland), I deem it a little hard, if not unjust, that at one "*fell swoop*" you should number me with "*quacks*" and "*false pretenders*."

I greatly admire "the noble sentiment of our elegant satirist" with which you commence your quotation from Mr. Matthews's work, and conscientiously, sincerely, and solemnly, I declare,

> "Oh! give me honest fame, or give me none!"

How far I am deserving of such fame is best known to those who have read my work, or witnessed my labours in this new field of science—to those, explanation is not necessary; but to persons to whom I am unknown, and into whose hands your Magazine may find its way, I ask you, in candour, "whether you do not conceive the lines alluded to are not calculated to injure my character as an author as well as a practical man?

> "Who steals my purse, steals trash"—

you know the rest.

* * * * * * *

Having been accused by you of quackery, it devolves upon me (I must say very unwillingly) to show that such epithet does not belong to me. To vindicate myself, I have ample means; but, at present, I shall content myself with giving you a few hints relative to the Gas Meter, a discussion about which, for Mr. Clegg's sake, I had hoped I should never again have occasion to go into; but as in 1819 I stood forward as the champion of Truth, so in 1827, I come into the field with equal vigour, fully as well armed, and prepared for the contest in the same cause. As I expect you will cause this letter to appear in your Magazine, I will not fill its pages with irrelevent matter. Without dissecting what is there said about the meter, I will only ask any mechanic (it is for such your work is published), whether, from the description given (and which is the same in Mr. Matthews's compendium), he could understand the construction and action of the machine. I say, and say boldly and confidently, he could not—I say more, the diagram is not a faithful representation of the meter as constructed by Mr. Crosley, and the description is imperfect and unintelligible. Of the *Tell-Tale*,

the *Pressure Indicator, the Apparatus for Registering the Impurities of the Gas* and *the Instrument for Ascertaining the specific Gravity of the Gas*, I am well prepared to speak. On these subjects, however, I choose for the present to be silent; nor shall I say much more now about the gas meter. I would rather refer such as have any doubts as to what I have said of that machine (in my work on Gas Lighting), to the 30th volume of the Repertory of Arts (second series), where they will find Mr. Clegg's gas meter specified, and plates of it given; and to the 37th volume of the Transactions of the Society of Arts, page 167, &c., where they will find Mr. Malam was rewarded with the gold Isis medal, for an improved gas meter (of which a plate is given). After comparing one with the other, I feel satisfied they will know (having one of Mr. Crosley's meters, as now made, before them, or the diagram in your Magazine, or Mr. Matthews's book), without my pointing it out, whether the gas meter now used most resembles the one for which Mr. Clegg took out his patent, or that improved one for which Mr. Malam was rewarded by the Society of Arts.

I am, Sir,
Your obedient Servant,
T. S. Peckston.

66, Grosvenor-terrace, Horse-ferry-road, Westminster,
26 *Dec.* 1827.

PERPETUAL MOTION POSSIBLE.

Sir,—This subject has been so often discussed in your valuable periodical work, that before you close your paper for ever on this head, will you permit one of your constant readers to add his mite to the general information displayed hitherto by your scientific communicators. Many of your readers seem to have imbibed very erroneous opinions on this grand desideratum, both as regards its *utility* and its *practicability*.

First, It is supposed by many, that, when it can be found, very many useful and entirely new effects will be produced. This is an error; for if it should be discovered, no advantage of this kind would follow; as it is the *regularity* of motion, not the perpetuity of it, that would be advantageous or useful. Mere motion in perpetuity would be of no avail, or at least not worth the expense of erecting any machine to continue it in another form. The determination of the longitude, which many so fully anticipate, would be as far distant as ever. Perpetual motion can, in fact, be obtained by a common watch, by winding it regularly up, (for it is perpetual if it never stops till the works are worn out); but the chronometer is no nearer perfection on that account. Some also seem to entertain an idea that a reward from the English government awaits the discoverer of perpetual motion: this is only imaginary, as no such reward ever was or could be offered for what would benefit no one. True it is, that the person who discovers a certain way of finding the longitude, in any or every place (chiefly on the sea), will be entitled to a reward from the Commissioners of Longitude, let that method be what it may; and as perfect *regularity* of motion would make a perfect chronometer in itself, such perfect regularity, if found, would be the means of obtaining the longitude, setting aside perpetuity, as of little or no consequence in the affair. Hence the makers of chronometers turn their attention always to the perfection of the *regulation part* of the machine; for if a common watch, to be wound up daily, could be made to show *mean time* truly, it would be infinitely superior to any chronometer or timepiece wanting regulation, though it required to be wound up once in seven years, or in one hundred years, or went perpetually without being wound up at all.

Next, as to the *practicability* of perpetual motion, though so many doubt it, I, with several others, not only assert that it is practicable, but that it has already been found out, or discovered; and, as appears to me, in

the most satisfactory manner possible: I do not mean by mechanical powers alone, but with their assistance, conjoined with the powers of nature. We need not examine into the pretended inventions, whether patent or otherwise, of those authors who assert the discovery by mechanism alone. The celebrated B. Martin, in his "Philosophical Grammar," p. 125, gives the complete reason in the following words:—

"According to the present constitution of things, there can be no mechanical perpetual motion; for the motion produced is but proportional to the generating force; and all motions on this globe being performed in a resisting medium, viz. the air, a considerable quantity of the motion must, in the communication, be spent on this medium; and consequently it is impossible the same quantity should return undiminished upon the first mover, which yet is necessary towards a perpetual motion; besides that, such a diminution of motion will be greatly increased by the constant friction of the parts of the machine, for there will be more or less of that, be the instrument ever so well contrived, there being no such thing as absolute smoothness, or perfect congruity, in nature; at least, not in any of the works of man."

The incredulous on this head, though zealous in the cause, have nevertheless pursued their desires this way, and the Patent Office at Washington, in the United States of America, is adorned with models patented as perpetual motions, but standing there MOTIONLESS as the models of all the other patents about them.

A Doctor, whose name I forget, with his companion, took out a patent, in England, for a mechanical perpetual motion, which figured in the "Repertory of Arts" about twenty-five or thirty years past. It consists of a wheel; on the side of its circumference, at equal distances, are placed about twelve boxes; a metal ball is put in each box, on one side only, which presses down that side of the wheel, and falls out, when at bottom, into a sort of bucket, or other box, which last equal in number those on the circumference; but these are fixed on a strap, or double chain (exactly like the buckets used in wells on the Continent, when oxen are employed to raise water; they descend on one side, mouth downwards, and, turning in the water at bottom, ascend full on the opposite side), passing over a shorter wheel at top, turned by the axis of the great wheel: when at top, the bucket, in turning over, empties the ball into a trough which slopes to the circumference, and guides the ball into one of the boxes there, where it was at first; and so is supposed to continue the motion in perpetuity. Of this, nothing more was heard of (as I can find) from the time of its discovery or publication; but this does by no means forbid the employment of mechanics united with other means. There are several parts of nature, which, of themselves, are perpetual motion, and require only mechanics to regulate them. First, there is the rise and fall of the tides; second, the waves of the sea; third, the wind; fourth, the variation of weight of the atmosphere; fifth, electricity; sixth, expansion and contraction, by heat and cold, &c. &c. &c.: nor does the art appear so much in applying them to machines, as the regulating the motions when so applied. Of the practicability, however, there can be no doubt. By perpetual motion, as it is generally understood, I mean, a machine once set in motion, that will go without any further human assistance till the works are worn out by time, or its materials decay. Now this, I again repeat, has already been accomplished, and that by a Mr. Coxe, a celebrated machinist, and I believe maker of various other automata, as to have a museum formed of them. As this was exhibited to the public about the middle of the last century for several years, it must have been generally known at that time—(I think this was the most celebrated of his works). The only account I at this time can give of it is this:—it was a watch capped, jewelled, and

protected from friction in every part as much as possible; without any main spring, the inventor so applied it to the mercury in a barometer attached to it, that the rise and fall of the mercury gave motion to the timepiece or watch: and the best part of the invention was, that if the barometer were taken away, the timepiece would go a year without it; if applied, the power would continue it—and it had a contained self-regulator, to let off or adjust all excess of power caused by the rise and fall of the barometer.

As this machine was made public and an engraving printed of it, (I think in some Magazine of those days), should any of your readers be in possession of the work containing it, perhaps they will have the goodness to communicate to your entertaining work all the particulars. I had the leaf with the engraving and the description thereon, which I gave about 20 years ago to a watchmaker, now, if alive, residing somewhere in the Fens, but of whom I never more heard: he was endeavouring to find out the perpetual motion, and this I thought would assist him. I do not know whether Coxe's Museum was exhibited before or after Martin's Museum, which I believe also consisted of scientific automata.

Thus was perpetual motion discovered—for such it was in every sense of the word; and that it is feasible in other ways, I think no one can doubt. The chief ingenuity of Mr. Coxe was, in applying the perpendicular difference of height in the column caused by the variation of the atmosphere's weight, with a self-regulator. I do not recollect whether it was regulated to that perfection as to keep to *mean time:* its being perpetual motion, did not of necessity imply this, though, perhaps, it came as near it as any other chronometer on the steel-spring construction. The engraving showed, chiefly, the front view.

The waves of the sea could certainly be applied to produce a regulated perpetual motion; and I have read somewhere, though my memory at this instant does not assist me in particulars, that a Frenchman had made a mill or some machine to be wrought by the waves only;—I think it is related in some of their Society Transactions. The rise and fall of the tides would also make a constancy or perpetuity of motion, wanting a self-regulator;—there are tide-mills on the Thames and other places. And I now hear that a Frenchman has invented a timepiece set in motion by the wind; which, on the principle of Coxe's barometer-watch above mentioned, probably has sufficient wind in any one week, or month, to supply it for a year, and a kind of self-adjusting escape to let off the surplus power; and which is to all intents and purposes actual perpetual motion. I might refer to many other things, more curious than useful, causing differences by themselves, as of contraction and expansion by cold and heat—accumulation and exhaustion, as by rain and evaporation, as well as to a variety of natural causes; any of which, if the necessary self-regulating mechanism were applied, would perform a similar continuity of action, and which would as certainly be perpetual motion, though of no use. For the winding up of a clock, as a prime mover, can be regulated much easier than any other machine yet known. Metals are found to expand *every way*, but wood only in the width of the fibre; hence, a wooden pendulum has not yet been found, I believe, to expand only across the grain (which is of no consequence), and not in length. Let me, therefore, advise those of your juvenile readers, not to attempt perpetual motion *alone;* next, that perpetual motion, of itself, is of little or no use unless it can be duly or properly regulated: and that a regulation of any of the present known powers, will be of more service than perpetual motion itself when alone found.

I remain,
Your constant Reader,
H. TODD.

LIST OF NEW PATENTS.

HENRY PINKUS, of the city of Philadelphia, in the state of Pennsylvania, in

the United States of America, gentleman, for his having invented or found out an improved method of purifying carburetted hydrogen gas, for the purposes of illumination. Dated 17th November. (*Six months.*)

Mr. Samuel Sevill, of Brownshill, in the parish of Bisley, in the county of Gloucester, clothier, for his invention of certain improvements applicable to raising the pile and dressing woollen and other cloths. Dated 20th November. (*Six months.*)

Robert Wheeler, of High Wycombe, in the county of Bucks, brewer, for his having invented or found out an improvement or improvements on, or in, refrigerators for cooling fluids. Dated 22d November. (*Six months.*)

William John Dowding, of the parish of Poulshot, in the county of Wilts, clothier, for his invention of certain improvements in machinery for rolling or rollering wool from the carding engine. Dated 22d November. (*Two months.*)

John Roberts, of Wood-street, Cheapside, engineer, and George Upton, of Queen-street, Cheapside, oil merchant, both in the city of London, for their invention of certain improvements on Argand and other lamps. Dated 24th November. (*Six months.*)

John Alexander Fulton, of Lawrence Pountney-lane, Cannon-street, in the city of London, spice merchant, for his invention of a process of preparing or bleaching pepper. Dated 26th November. (*Six months.*)

Joseph Apsey, of John-street, Waterloo-road, in the parish of St. Mary, Lambeth, engineer, for his invention of an improvement in machinery, to be used as a substitute for the crank. Dated 27th November. (*Two months.*)

Joshua Jenour, jun. of Brighton-street, in the parish of St. Pancras, in the county of Middlesex, gentleman, for his new invented cartridge or case, and method of more advantageously enclosing therein, shot or other missiles for the purpose of loading fire-arms and guns of different descriptions. Dated 28th November. (*Six months.*)

Thomas Bonner, of Monkwearmouth-shore, in the county of Durham, merchant, for his invention of certain improvements on safety lamps. Dated 4th December. (*Six months.*)

William Fawcett, of Liverpool, Lancashire, engineer, and Matthew Clark, of the Island of Jamaica, engineer, for their invention of an improved apparatus for the better manufacture of sugar canes. Dated 4th December. (*Six months.*)

Robert Water Winfield, of Birmingham, in the county of Warwick, brass founder, for his invention of an improvement or improvements in tubes or rods, produced by a new method or methods of manufacturing, and in the construction of, and for manufacturing the same with various other improvements into parts of bedsteads and other articles. Dated 4th December. (*Six months.*)

John Meaden, of Millbrook, near Southampton, in the county of Hants, coach maker, for his invention of certain improvements on wheels for carriages. Dated 4th December. (*Six months.*)

Samuel Wilkinson, of Holbeck, in the county of York, mechanic, for his invention of improvements in mangles, which he intends to denominate Bullman's Patent Cabinet Mangle. Dated 4th December. (*Six months.*)

Maurice de Iongh, of Warrington, in the county of Lancaster, cotton spinner, for his invention of an improvement or improvements in machines adapted for spinning, doubling, twisting, roving, or preparing cotton, and other fibrous substances. Dated 4th December. (*Six months.*)

Thomas Tyndall, of Birmingham, in the county of Warwick, gentleman, in consequence of a communication made to him by a foreigner residing abroad, for improvements in the manufacture of buttons, and in the machinery or apparatus for manufacturing the same. Dated 4th December. (*Six months.*)

Daniel Ledsam, and William Jones, of Birmingham, in the county of Warwick, manufacturers, for their invention of certain improvements in machinery for cutting sprigs, brads, and nails. Dated 4th December. (*Six months.*)

NOTICES TO CORRESPONDENTS.

Communications received from C. F.—R. Cross—G. Pringle—Georgius—P. S. J.—Dixon Vallence—S. N. L.—Jacobus—Aurum—An Ex-Leicestershire Farmer and Grazier—J. H.—Henry XXX—Tela.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 229.] SATURDAY, JANUARY 12, 1827. [Price 3*d*.

"The ancients used to say, that the Gods *sold* us every thing, but *gave* us nothing. To the same effect is our Scripture precept—*In the sweat of thy brow shalt thou eat bread.*"—Colton.

STEAM COOKING APPARATUS OF THE LANCASTER LUNATIC ASYLUM.

Fig. 1.

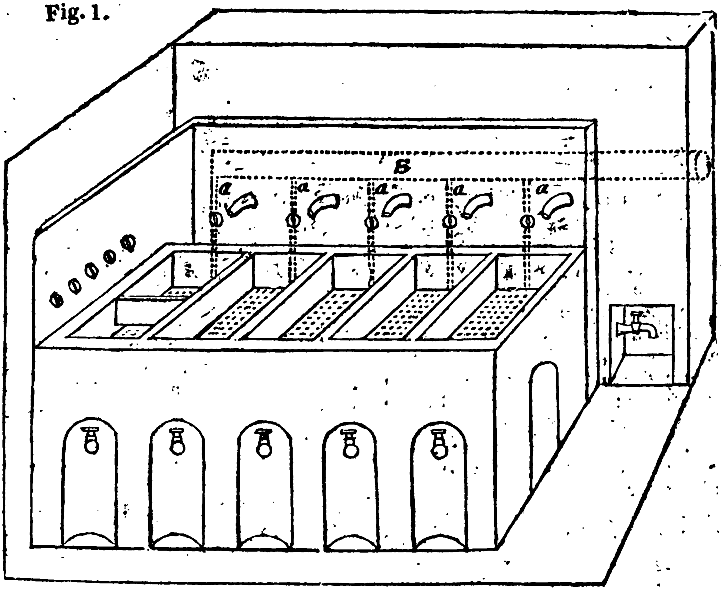
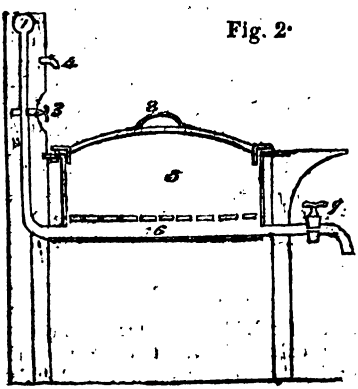


Fig. 2.



Sir,—I now send you a drawing and description of a Steam-cooking Apparatus, lately designed and executed by Mr. W. Maysland, plumber, glazier, and tin-plate worker, of this town, for the Lancaster County Lunatic Asylum; and which, from all I can learn, is of a very novel and superior description. I had the pleasure of seeing it when it was in operation, preparing dinner for the patients and servants of the establishment, to the number of about four hundred. I was informed that the cook can, by means of it, make dinner ready in one-sixth the

time which was required by a former steam apparatus on the old system. The chief novelty in the present plan, is the admission of the steam into the pans among the meat and vegetables. I put the question—Whether the flavour of the food was not injured by this means? The answer was, that the Governor, and every person belonging to the establishment, considered the flavour greatly improved by the admission of the steam.

Description of the Drawings.

Fig. 1 exhibits a view of the pans, five in number, with the lids off: they are each about 16 inches deep. S is the main steam-pipe, which is supplied from a boiler used in another part of the establishment for other purposes; *a a a a a* are branch-pipes communicating with the pans.

Fig. 2 is a section of the apparatus; 1 the main steam pipe; 2 a branch pipe; 3 the tap handle for regulating the admission of the steam, so that one pan may be used, or the whole; 4 a pipe for letting cold water into the pans when wanted; 5 a stage on which the meat is placed; 6 an opening in the bottom of the pans: between 5 and 6 there is a shifting bottom full of small holes, for the steam to get in amongst the meat, and when porridge is making for breakfast this bottom is taken out; 7 a tap for letting off water when the pan has to be cleaned; 8 the lid put loosely on.

When inspecting this apparatus, I observed what I thought one slight inconvenience attending it. The steam, when it escapes from the pans, flies about the room, and has no other outlet except through the windows, which must be frequently opened for the purpose. Perhaps some of your ingenious readers could point out a plan for obviating this evil. I shall at the same time be glad to learn, whether any apparatus of this description has been hitherto constructed elsewhere.

I remain, Sir,
Yours, &c.
M. SAUL.

OILS AND LOTIONS.

Macassar Oil is merely oil of almonds coloured red with alkanet root; Russia Oil, the same thing rendered milky, by a small quantity of ammonia of potash scented with oil of roses. The nostrums for eruptive diseases, called Gowland's Lotion, Milk of Roses, Caledonian Cream, Kalydor, &c. consist merely of a solution of the oxymuriate of mercury in almond emulsion, with a proportion of sugar of lead or white oxide of bismuth. They are thus possessed of certain stimulant and repellent properties; and though blunted, in part, by the medium in which they are involved, cannot fail to be highly active on the skin, and consequently injurious.—*Stevenson and Churchill's Medical Botany, No. XI.*

HOW TO KEEP HARES AND RABBITS FROM APPLE TREES.

Take common train oil and hog's lard; mix them well, till they are of the consistence of thick paste, and apply it rather sparingly with a painter's brush to the trees. This will effectually keep off those destructive vermin, and not injure the tree, as the lard neutralizes the pernicious effects of the oil.—*Gardeners' Magazine.*

ANSWER TO THE FLY-WHEEL QUESTIONS, AND RULE FOR FINDING THE CIRCLE OF GYRATION.

Sir,—The opinions respecting the use and application of the fly-wheel connected with machinery, have been various; so that only the initiated can apply it to advantage, with success. In vain have I searched authors for formulæ to express its powers and its resistances. In searching through the seven volumes of the "Mechanics' Magazine," I find the best description of the fly-wheel in No. 84, vol. iii., abstracted from Dr. Brewster's Appendix to "Ferguson's Lectures;" but there is no rule laid down for the necessary calculations. I have waited anxiously to see an answer to R. T.'s

Questions, in No. 192, vol. vii.; and finding no person disposed to take up the subject, I shall venture my humble opinion and calculations on this important subject, in hopes of extricating some seeking mind from slavery, either through means of my own calculations, or from what I may excite from others.

I shall take, for example, a fly-wheel 18 feet diameter, driven by a 20 horse power steam-engine (such a one is now erecting at Tring Silk Mill), with a crank of 2½ feet radius, and making 22 revolutions per minute. Assume the weight of the wheel =1000 lbs.

1st. Not taking the resistance of the air into account, we may assume that a wheel of any size may be put in motion by adding 1 lb. per foot radius of the wheel, as an equivalent for the friction on its axis; so that our wheel, of 18 feet diameter, would move a few inches by adding 9 lbs. to its circumference;—for the sake of round numbers, we will say 10 lbs. Then, to find the accelerating force, the formulæ is $\frac{W-w}{W+w}\times 16\frac{1}{12}=F$; which in this case is $\frac{510-500}{510+500}=\frac{10}{1010}=\cdot0099\times16\frac{1}{12}=\cdot16$ of gravity, or F; *i. e.* $\frac{16}{100}$ of a foot space, and 3·2 feet velocity in the first second of time; and if not impeded by the resistance of the air, would gain a velocity =20½ feet per second, in 2½ seconds of time. An equivalent power applied at the crank, 2½ feet radius, will require 36 lbs. power.

2d. Taking the resistance of the air into account, which writers estimate to increase as the square of the velocity,[*] and which here amounts to about 26 lbs. when equivalent to the velocity of the wheel when in train, to which add 10 lbs. for the friction on its axis, = 36 lbs., the power required to act on the circumference of the wheel; hence we see it will require as much force at the circumference (taking the resistance of the air into account), as before we calculated at the crank; and the calculation will be $\frac{536-500}{536+500}=\frac{36}{1136}=\cdot0347\times16\frac{1}{12}=\cdot558$ feet space, and nearly 6 feet velocity in the first second of time. An equivalent power acting at the crank would require 130 lbs.

I likewise find that it would require 680 lbs. power at the circumference, to give the wheel a velocity of 20½ feet in the first second, which is the uniform velocity generated by the engine.

The velocity generated at the end of 170 seconds of time =2′ 50″, when a constant force of 36 lbs. is acting at the circumference of the wheel 18 feet diameter, would be 6×170=1020 feet, a velocity equivalent to the force of gunpowder required to fire a ball of 1 inch diameter.

Now, suppose the engine to act with a power of 10·080 lbs. at the crank, = 3000 lbs. at the circumference, for the space of 37 seconds, it would be equivalent to 36 lbs. acting 170 seconds.

Thus, we find a fly-wheel is a generator or reservoir of power, when judiciously applied either to force the crank of a steam-engine past its centres, or in regulating machinery driven by a horse, when the horse acts by intervals.

It may not be amiss here to give a rule for finding the circle of gyration.

Rule.—To twice the weight of the wheel, multiplied by radius squared, add the weight of power; then divide by twice the sum of the weight of the wheel more than the weight of power, and the square root of the quotient will be the radius required.

For the sake of those who have not vol. iii., I may mention that Mr. Bevan there gives the following Rule:—

Let R denote the distance from the centre to the outside of the rim, and r the distance from the centre to the inside of the rim; then,

$\sqrt{\frac{R^4-r^4}{2\,R^2-2\,r^2}}$=distance or radius of gyration.

I am, Sir,
Yours, &c.
WM. ANDREWS.

13*th Dec.* 1827.

ON IMAGINARY QUANTITIES, AND THE LAWS OF FALLING BODIES.

Sir,—As it appears that your late esteemed correspondent, Mr. Felix Ford, or rather the Rev. Dr. Evans, has paid the debt of nature, and that Mr. William Russell declines writing any more on the arithmetic of imaginary quantities; and lastly, as Mr. Henry Ottley himself has taken farewell of the subject, I cannot do otherwise than follow their example. In conclusion, however, I must beg leave to make a few remarks on Mr. H— O—y's last letter (No. 225), where he states—

"Mr. G. S. is mistaken when he supposes that I mean to say, that the product of $\sqrt{-3}$ by $\sqrt{-3}$, should be taken equal to $+3$ in practice; all my object was to show that it was mathematically correct, and that, according to strict mathematical principles, Mr. Darley was right in stating, that $\sqrt{-a}+\sqrt{-b}=\pm\sqrt{ab}$."*

This is rather a singular way that Mr. H— O—y has now recourse to, for the purpose of hedging out (excuse the slang phrase). He informs us that the result of a pure proposition in algebra, may be mathematically true, but, if put to the test of practice, it may produce an absurdity. If this is sound logic, it must belong to the New Light System. For my own part, it appears to me mere sophistry; his method of trying to remove my misgivings, seems to be the very climax of the New Light System—such as, assuming $2=-1+\sqrt{-3}$!!! In conclusion, Mr. Editor, I shall only add, that if any of the algebraical readers of the "Mechanics' Magazine" should entertain the slightest doubts on the subject, let them consult the first volume of Bonnycastle's Algebra, where they will find the matter amply discussed, and they will perceive at once on which side the truth is to be found. So much for imaginary quantities. Now, Sir, a few words more as to the New Light System of the laws of falling bodies.

Mr. Henry Ottley, in No. 218, page 236, informs us, that in my letter (No. 217) I have proved my entire ignorance of the laws of falling bodies: to this I shall only reply, that if it must be concluded that my ignorance necessarily follows, because I happen to disagree with him, I cannot see why I should be *much ashamed of my ignorance.* How far the above charge is justly applied, will appear from the following facts; and first, fortunately for me, Mr. Henry Ottley has given *his own rules* on the laws of falling bodies (No. 215, page 188), where he states—

"For although no body falls through 16 feet per second in the open air, and though the velocities with which various bodies will fall through the air differ, yet the following *principle is universal, whether in the open air or in a vacuum.* The space, through which any body will fall in a given number of *seconds*, is equal to the space fallen through in the first *second (whatever that space may be)* multiplied by the square of the number of seconds," &c. In conclusion, he adds, "Hence it appears that the depth of a pit may be found without voiding it of air," &c.

Now, Mr. Henry Ottley, to the above laws, which you roundly assert to be universally true,* I do not intend to oppose any fanciful principle founded on any pretended theory of my own, but merely some practical information which I am in possession of on this subject, and for which I am mostly indebted to the writings of Mr. Robins and the late illustrious Dr. Charles Hutton. You state that no body falls through 16 feet in the first second in the open air. Dr. Hutton

---

* Mr. Darley has stated no such thing. In his "Algebra," he says, at the bottom of page 56, that "$\sqrt{-a}\times\sqrt{-b}=\sqrt{ab}$." (See No. 196, p. 330.) It is Mr. H— O—y, and he alone, that contends that $\sqrt{-a}\times\sqrt{-b}=\pm\sqrt{ab}$.

* The whole of the New Light System consists of nothing but pretended axioms and unsupported assertions: they avoid demonstration, in the same way as they would flee from a *demon.*

has furnished us with many experimental equations from which we can put this first part of your *universal law* to the test.

Example.—What will be the terminal velocity of a cast-iron ball weighing $1\frac{1}{20}$ lbs., after having descended $16\frac{1}{12}$ feet, the motion commencing from rest?

Dr. Hutton's experimental equation for solving this problem is,

$$x = \frac{w}{4gc} \times \text{Hyp. Log. } \frac{w}{w - c\,v^2}$$

(see p. 292, vol. iii. of the Course), where $x = 16\frac{1}{12}$, $w = 1{\cdot}05$, $4\,g = 64\frac{1}{3}$, and $c = {\cdot}00001725$ (p. 279.)

Solution.—Since $x = \frac{w}{4gc} \times$ Hyp. Log. $\frac{w}{w-c\,v^2}$; hence, $\frac{4\,g\,c\,x}{w} =$ Hyp. Log. $\frac{w}{w-c\,v^2}$. But $\frac{4\,g\,c\,x}{w} = \frac{64\frac{1}{3} \times {\cdot}0000 \times 16\frac{1}{12}}{1{\cdot}05} = {\cdot}01700008$. The natural number answering to this Hyperbolic Log. is $1{\cdot}0171443 = a$

$\therefore \frac{w}{w - cv^2} = a$, from which

$$v = \sqrt{\frac{(a-1)\,w}{a\,c}}$$

$$= \left(\frac{{\cdot}0171443 \times 1{\cdot}05}{{\cdot}00001725 \times 1{\cdot}0171443}\right)^{\frac{1}{2}} = 32{\cdot}03$$

feet; from which it is apparent that a heavy body whose specific gravity is not less than that of cast iron, and weight $1\frac{1}{20}$ lbs. will fall something more than $\frac{32{\cdot}03}{2} = 16{\cdot}015$ feet in the first second.

Dr. Hutton's second experimental equation is $t = \frac{1}{4\,g}\sqrt{\frac{w}{c}} \times$ Hyp. Log. $\frac{\sqrt{\frac{w}{c}} + v}{\sqrt{\frac{w}{c}} - v}$; and putting $v = 32{\cdot}03$, then t will be found to be one second.

Dr. Hutton has also shown that a ball of the above weight and specific gravity, after having acquired a velocity of 246 feet, will afterwards descend with a uniform velocity. Hence, if Dr. Hutton's theorems are true, the whole of the New Light System of the Laws of Falling Bodies *falls to the ground.*

I am, Sir,
Yours, &c.
G. S.

Dec. 24, 1827.

IMPROVEMENT ON WHITE'S CONCENTRIC PULLEY.

Sir,—I have long regretted that Mr. White's beautiful invention of the concentric pulley should be rendered almost entirely useless: sometimes by the imperfection of the workmanship, and frequently by the impossibility of procuring unyielding and equable cords, either of which must slide over the wheel, and thus introduce worse defects than those they are intended to obviate; for in the common sheaf, each wheel turns independently of the others, so as to move with the cord in case of its stretching, &c. I flatter myself, that the alteration I am about to describe will be found to obviate all these inconveniences, without at the same time infringing upon the peculiar advantages of Mr. White's invention. It is simply this: let the pulley be made exactly in the proportion specified, but instead of being one single wheel, let it be divided, so that each groove may be separate, and turned independently of the others. Perhaps some may say that it is then a common sheaf: I answer no! for while the cord continues unstretched, and of the proper diameter, the whole will revolve together as one wheel; but as soon as the cord stretches in one particular part, the pulley acted upon by that part will move, as it were, a little before the others, and the operation will then proceed as before. If, again, the cord be too large or too small, or if the wheel should not be accurately constructed, ("defects which are but too real," as Mr. White admits), this would not be detrimental, because each pulley would then have a relative motion with respect to the others, *which motion could not, in any*

possible case, amount to that of a common sheaf, although it would be somewhat greater than in Mr. White's pulley when in perfect working order.

I am aware of Mr. White's idea of beginning the series by one or more loose pulleys, and my alteration may at first sight appear to be the same thing; but, upon investigation, it will be found essentially different, inasmuch as Mr. White's are only intended to make the dimensions of the pulleys more convenient and manageable, and mine to destroy the immense friction arising from the cords being obliged to slip over the surfaces of the wheel.

If Mr. White should see these hints, and should deem them worthy of an observation or two from himself, he would confer a great obligation not only upon myself, but, I doubt not, upon, many of your readers.

Yours,
CHELMERIENSIS.

BREWING.

Sir,—As A. Z. (p. 151, vol. viii.) seems to be so much afraid of boiling his wort for such a length of time, I beg to inform him, that he cannot produce a well-brewed drink unless he does: that it may be palatable there is a probability; but he cannot extract the valuable properties of the hops in one hour's boiling, nor can he, to use the language of your Bristol correspondent, "deposit the gluten." As I before said, I recommend him to boil for three hours, *not too rapidly*, until, upon taking out a sample from the copper, the wort is found to contain minute flakes like curdled soap, which I have no doubt consist of the gluten and starch of the malt, separated by the joint action of the heat and the bitter extract of the hop, and which, previous to boiling, had been held in solution in the raw wort. W. H. in my opinion errs, when he says "Boil till all the gluten is *deposited*." The gluten is separated from, but still floats in, the body of the wort, until the wort, being cooled down to a certain temperature (about 80°, I believe), becomes turpid, deposits the heavier particles of the gluten and starch on the COOLERS, and carries into the fermenting tun the remainder. Perhaps the following calculation, which I have found by *long practice* to be correct, would be much nearer the waste than A. Z.'s:—

3 Bushels of malt absorb, say,* . . .	11 Gals.
½ Evaporation, &c. on 24 Gs.	8 —
Sundry Wastes, 1 per. ct.	½ —
To fill Casks . .	24 —
	43 to 46

So that I am inclined to think, if A. Z. have a cover to his mash tun and copper, a copper holding 50 gallons would be full and adequate for a mashing of 3 bushels of malt; he will likewise find his hops produce a much superior drink, and be really inclined to follow the advice of,

Sir,
Your obedient Servant,
A BREWER.

Cork, Nov. 1827.

P.S. If your correspondent * (p. 190, vol. viii.) dissolves his isinglass in *hard* beer, and puts no other finings to his beer but in the proportion of a quart to 36 gallons of beer (the isinglass to be fully dissolved, and then thinned with more hard drink), he will find a great advantage.

BED-ROOM STOVES.

Sir,—A correspondent in the "Mechanics' Magazine," No. 224, says that any of your readers would confer a great benefit on the country, if they would invent a small stove for a sleeping-room, &c.

I have a bed-room in my house, the wall of which is very damp in winter, and am under the necessity of having a fire very often to air it. The house is erected under the side of a hill, and the wind at some points blows the smoke, soot, &c.

* In a large brewing, the malt should not absorb nearly so much.

into the room. I have made several attempts to cure this with chimney caps, &c., but without effect; what I have done this winter has answered my utmost wishes. I have placed a small cast iron stove in the fire place on two brick hobs; it is 18 inches long, 12 inches wide at top, and 9 inches at bottom, and 12 inches deep, and ¼ thick; with a small door in front, a grate, &c.: a square socket, of 3 inches long, by 5 inches, is cast on the top to receive a wrought iron pipe, to which a damper is fitted, to regulate the draught, or shut it altogether. In the lower part of the chimney, I have a thin cast iron plate fixed and cemented air tight; this has a hole with a socket, 1 inch deep, cast in it to correspond with that of the stove, to let the pipe pass through: it is half an inch larger than the pipe: this is fitted in either with fine mortar or fine clay, and is made air tight likewise. This sort of cement is easily broken, to enable the pipe to be taken down to introduce the arm to clear the plate of the soot, dust, &c. that may lodge on it.

Such is the strength of the draught in this, that I can make the stove red hot in half an hour, and heat the air in the room to 80° and upwards.

In the fore part of the day a fire is lighted, with coals only, in it; and the damper is regulated so as to make the fire burn gently, and regulate the heat in the room; this will last several hours, and want no further attendance for the day: it is quite clear from dust and smoke; shutting the damper close when the fire is out, effectually prevents the wind blowing the soot, &c. into the room at night, as was formerly the case, to my very great annoyance.

I am, Sir,
Your's, &c.
P.
One of the First Subscribers to the Mechanics' Magazine.

WRIGHT'S PATENT CRANE.

Sir,—I have read, with surprise, the several articles in the "Register of Arts," on this subject. I am astonished that any person pretending to instruct the mechanic, and criticise the inventions of talented engineers, should show himself so entirely ignorant of the subject as the Editor of the above Journal has done on this occasion.

He asserts that no power can be gained but at the expense of velocity; and laughs at the pretensions put forth to the contrary effect. Now, this critical gentleman is theoretically right; that is to say, if both machines moved without friction, then, indeed, one of them, to produce a greater power, must go at a slower rate. But the actual state of the case is very different: there is friction in both the cranes in question; and therefore, if Mr. Wright's crane is so constructed as to move with less friction and resistance, then may not this advantage be applied either in velocity, or power, or both? Such, I think, is the case; and had the aforesaid Editor condescended to consider the matter a little, before he gave out *his* opinion, the much-dreaded title of a "dogmatizer in science" would, perhaps, not have been applied to him in this case.

I am, Sir,
Yours, &c.
COMMON SENSE.
Blackwall, Jan. 2, 1828.

GRATUITOUS SERVICES.

Mr. Editor,—The propriety of the system of receiving gratuitous instruction and assistance at Mechanics' Institutions having been very fully discussed in your pages, I take the liberty, through the same medium, of calling the attention of your readers in general, and the members and conductors of Mechanics' Institutions in particular, to the proceedings at the last Quarterly Meeting of the Members of the Parent Institution—as affording a very striking and practical illustration of the evil effect of the gratuitous system, considered both with respect to its merits as an honourable system, and as one of policy. The treatment which the London Mechanics' Institution received on that

occasion from their worthy benefactor and Vice-President, will deter, I hope, the managers of all other Institutions from pursuing a course likely to subject themselves to similar usage. I trust this example, held *in terrorem* before them, and a calm and honest consideration of the subject, will operate beneficially as a check to the spreading of this disgraceful system, and lead to its final and utter rejection, as unworthy the pursuit of men of independent minds.

Mr. M'William, when the Committee of which he was a member were charged with unskilfulness in the construction of the roof, retorted, as might have been expected, that neither he nor his enlightened colleagues were paid for their trouble, and he was, therefore, exceedingly astonished at the call for explanation. This was natural enough; and certainly it was very saucy of the members to show such signs of disapprobation as they did at the conduct of the Building Committee. They were their benefactors, and they should therefore have been content to put up quietly with any little insignificant insult they might choose to cast at them; it should have been, to have acted consistently, taken as a matter of course.

The members of this Institution will now feel a little of the miseries of dependence: they have long tasted its sweets, though, to their shame be it spoken, they found them sweets; they have voluntarily thrust their neck into the yoke, and nothing short of a few thousand pounds will ease them of it. I ardently wish that they may at length begin to feel it galling, and at least *desire* to be freed from it.

The gratuitous system has apparently always had the full approval of the MAJORITY of the members, judging from the obstreperous applause with which every announcement under it has been received by them. They have, therefore, in addition to all their inconveniences and trouble, the *pleasing* recollection of being *indebted* only to themselves for their *enjoyment* of them.

In the hope, Sir, that Mechanics' Institutions will take warning from this example, and refrain from *plunging themselves into heavy and injurious obligations for the sake of present advantage*,

I remain, Sir,

Yours, &c.

AURUM.

INQUIRIES RESPECTING TELESCOPE GLASSES.

Sir,—Having been for some time engaged in grinding and polishing reflecting specula for my own amusement, and having succeeded upon a small scale, I am desirous of proceeding farther; but having no means of communication with scientific men, I have thought the best method of procuring a solution to some questions would be to throw myself upon the kindness and intelligence of some of your practical readers. I have consulted the treatises of Smith, Mudge, and Edwards, and Brewster's article on Optics in the Edinburgh Encyclopædia, but cannot obtain satisfactory information as to the following points:—

1. What is the best proportion of thickness for the specula of Newtonian Reflectors? In Herschel's 40 feet reflector it was little more than one-fourteenth of the diameter. Might not this be adopted as a standard? Edwards's proportion applies to *Gregorian* telescopes.

2. What is the most approved method of supporting the speculum in its cell? in particular, what mode was adopted by Herschel? and what does Brewster mean when he speaks of attaching the speculum to a frame?

3. Are small sand-holes in the surface of specula so detrimental, that it is absolutely necessary to work them out? They often run deep.

4. What would be the greatest weight that could be managed by hand in polishing? and how did Herschel polish his 20 and 40 feet specula?

5. Supposing the small speculum was intended to include a field of

it be set from the focus, in order that the latter may reach sufficiently beyond the side of the tube to admit of the application of Huygenian eye-pieces with powers of from 50 to 500?

6. Why does the elliptical polisher, recommended by Edwards, communicate a parabolic figure? and how can his rule for the proportions of the ellipse in a particular case be made of general application to all focal lengths and apertures?

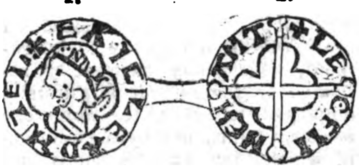
7. What is the best method for an observer to raise his seat to the eye-piece of a Newtonian reflector, when the instrument is long, and directed to a very elevated object? This seems to me a difficult point, unless the telescope is of such magnitude that a seat can be permanently attached to it.

A reply to these inquiries would much oblige your constant reader and well-wisher,

Dec. 22, 1827. TELA.

ANCIENT COIN FOUND AT ST. CATHERINE'S DOCKS.

1. 2.



1. ERIC LE ROIX SEIT or ZEN.
2. LEOFWIN EN ANT.

Sir,—I think TYRO's remarks (p. 348) are quite correct on the coin of Henry III., and I shall, probably, be able to elucidate the question a little by an inspection of some coins of that monarch in my own possession; but I am, at present, unable to offer any further information on that subject.

The object of my present communication is, to present to the observance of your antiquarian readers a coin of great curiosity, which was lately dug out of the earth in the formation of the St. Catherine's Docks.

I have enclosed you a drawing of it, which may be considered as pretty accurate. No. 1 is the obverse, or head side of the coin; and No. 2 the reverse, or contrary side. With the drawing, I have given my reading of the legend, or inscription. The coin is a silver penny, or skeatta; and I consider it to be either of Eric, a king of Northumbria, who lived in the ninth century, or of some Eric, king of Ireland. If the latter, it may have been struck at Antrim, as the reverse runs EN ANT.

The above is all conjecture, therefore I shall be very glad of any information which may lead to a right knowledge of this curious coin.

I am, Sir, yours, &c.
JOSEPH BROWN.

Cannon-street, London,
Dec. 19, 1828.

MUSTARD SEED.

Messrs. Stevenson and Churchill state, in their "Medical Botany," No. XI, that though the use of mustard has been found, in cases of indigestion, to restore the stomach and intestines to the regular performance of their functions, there are certain preparations of it so sophisticated, as to have a very injurious tendency. "Whitehead's Essence of Mustard" consists of oil of turpentine, camphor, and spirits of rosemary, to which is added a *little* flour of mustard. His "*Essence* of Mustard Pills," is balsam of Tolu with resin!

SIMPLE METHOD OF CUTTING ORIGINAL SCREWS.

Sir,—I shall be obliged by your inserting in the "Mechanics' Magazine," the following simple and economical method of cutting original screws:—

You must leave the piece of steel, from which you intend to form your tap, a little longer than necessary, and, having turned it true throughout, at one end turn down, somewhat lower than the rest, a neck or space of about half an inch in length; round this space coil a piece of wire, and you will at once be in possession of a primary, artificial guide, which will regulate the pitch of your intended screw. You have now nothing to do but to make

your tracing-tool to the spiral groove formed by the wire, and begin tracing your thread.

By this simple method, you may obtain, by varying the thickness of your wire, a screw of any required pitch, either right hand or left, without a traversing chuck, traversing mandrill, or any such difficult process and expensive apparatus.

GILBERT.

J.'s SAFETY PLANS FOR CARRIAGES.

Sir,—Although I am not a coachmaker, yet it appears very plain to me that not one of the four plans of J. (p.) would serve the purpose for which he has intended them, and for the following reasons:—

Plan 1st is objectionable, on the ground that the support would give way under the sudden drop of the coach; if made of cast-iron, it would snap; of wrought, it would bend; it would likewise be in the way in passing over rubbish, &c. on the road, be inelegant in appearance, and, if made of any iron, likely to stand a serious addition to the weight of the vehicle.

Plan 2d is subject to the like objections, and in a much stronger degree, as the proposed appendages would stand in the way of passengers getting in or out of the vehicle.

Plan 3d. The iron bolt would bend or break by the jerk: even allowing that the rod would catch exactly between two spokes at the time the string is drawn, the spoke would be liable to break, and the sudden stop would cause a serious disarrangement in the whole coach.

Plan 4th would not relieve the horses, but give them additional pain; for although the pole does, in a measure, pin them to the earth, it serves in a great degree to steady and give them confidence in their footing. This plan would throw the collar up, and painfully incommode the throat, by taking it off the withers, where it is much easier borne. The shaking of the end would also disarrange his hames, and confuse these noble, "*amiable*" animals.

The preceding are what I think insuperable objections to J.'s four plans; the opinion of a practical man would be decisive, and received with pleasure, by not only myself, but, doubtless, by J. and many others.

Your obedient Servant,

T. M. B.

SERIES OF PHILOSOPHICAL EXPERIMENTS AND ILLUSTRATIONS, &c. &c.

BY MR. WEEKES.

No. X.

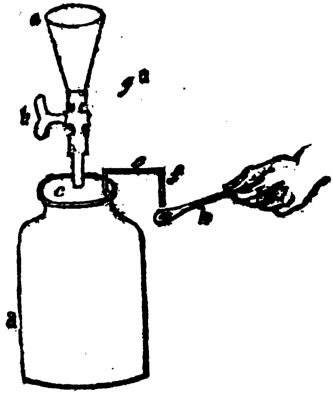
Portable Table Gasometer, Experiments with Chlorine, &c.

Few philosophical instruments possess a greater degree of importance in researches connected with that interesting department of science, Pneumatic Chemistry, than the numerous vessels denominated *gasometers*. These are various in form, and have their respective conveniences; but an economical and portable table-apparatus for manipulations of this nature is, perhaps, with many, still a desideratum. I shall describe a very simple instrument, which may be readily attached to the several jars usually employed to retain the numerous aëriform fluids, and by the addition of which they may be singly and successively, if required, converted to all the purposes for which larger and more expensive, though frequently less convenient, gasholders are brought into requisition, while they are, moreover, applicable in certain cases where the former could not be adopted.

The funnel *a*, (see fig.) having in its tubular portion the stop-cock *b*, passes air-tight through a good cork stopper *c*, at least one inch and a half in thickness, and which fits accurately into the wide mouthed jar *d*, capable of containing from a pint to a quart, or three pints, at pleasure. Near the periphery of the cork stopper *c*, a glass tube *e*, one-fourth of an inch in bore, and bent at right angles, arises, which must be also fixed in

35', how large should it be in a 7 feet telescope? and how far should

an air-tight state in the cork *c*. Into the end of the glass tube at *f*, seve-



ral jets of glass also, and of various diameters in their respective orifices, are carefully fitted by grinding, and, on their removal, the cap *g* fits accurately over the orifice of the bent tube, preventing the escape of gas and its accidental admixture with atmospheric air. The support *h*, of slate, charcoal, pipeclay, or glass, enables the operator to bring the substance to be acted on by the respective gases conveniently within their sphere of action.

The spontaneous combustion of phosphorus, the metals, &c. in chlorine gas, is among the most striking illustrations afforded by chemical science; and to produce these pleasing results, portions of the substance to be acted on are let fall into unstopped jars of the prepared gas: combustion, with an union, more or less complete, of the substances employed, is the instantaneous consequence; but from the rapid decomposition which obtains, the jar is instantly filled with a dense white cloud, which totally obscures, after the first moment, the progress of the experiments, besides occasioning an unavoidable loss of gas. Let the jar *d* be charged with chlorine, and, as soon as it can be removed from the pneumatic trough, insert the cork stopper *c*, with the apparatus appended. The funnel *a* is now to be filled with water, and the substance to be acted on being laid on the support *h*, is to be brought under the orifice of the jet *f*: upon turning the stop *b*, the water from the funnel slowly descends, and forces a constant current of gas through the tube *e*; and as soon as the desired effect obtains, which will be in a few seconds, if the gas be pure, and the manipulation properly conducted, the stop *b* is turned back again to prevent the farther descent of water, and consequent escape of gas. By this means, the most brilliant effects are produced, without the slightest inconvenience to the operator, or the loss of his materials—small volumes of gas only being employed.

Phosphorus, antimony, in small pieces or finely powdered, the metals, &c., are thus burnt with facility; but when metallic leaves, gold and silver for instance, are subjected to the action of a jet of chlorine, they should be deposited at the bottom of a small wine-glass; by which means they are prevented from being blown away, and, after a few seconds, are brought completely within an atmosphere of the gas. A jet with a somewhat large orifice, succeeds best in effecting the combustion of metallic leaves.

More than one jar will seldom be required for a single series of experiments of the abovementioned kind; but when the gaseous contents of the first jar are exhausted, the apparatus is transferred with ease to a second, third, or any number previously provided, in succession. It will be obvious that the principle of this apparatus is equally applicable to the exhibition of inflaming a jet of hydrogen by the action of spongy platina, the combustion of the metals upon charcoal by means of a stream of oxygen, and a variety of other manipulations.

FIRE-EXTINGUISHING APPARATUS.

Sir,—In a former communication (page 72), I briefly enumerated some of the difficulties attending the present method of supplying fire engines with water: I also laid

before your readers several plans for their removal; and, agreeably to my promise at page 290, I now conclude the subject, by a description of another plan for the same purpose, which was the first that originated with me, and is superior to those already described, (as this will ensure a *supply* of water which they will not,) yet being more expensive, the objection raised against the others will apply more forcibly to the present.

Fig. 1.

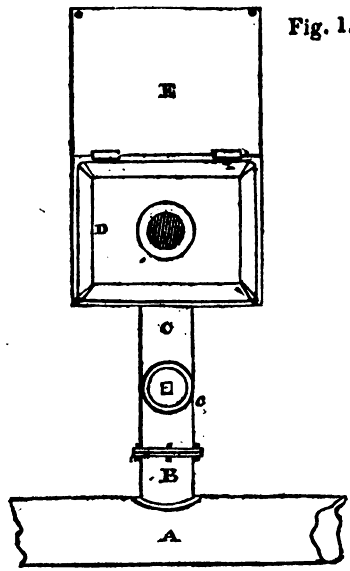
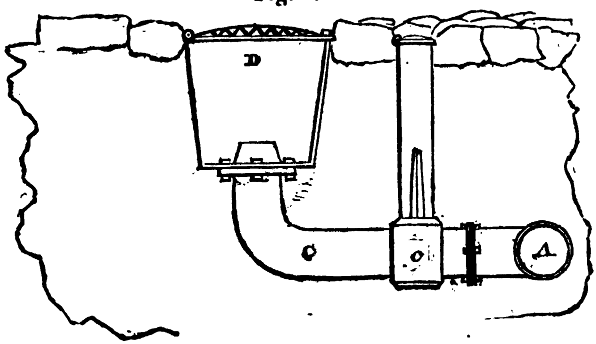


Fig. 1, A, is the ground plan of one of the water mains, furnished with a projection B at the side, having a collar for connecting it by means of screws with a corresponding collar on the pipe C, which has a cock *c* for turning the water off or on as required; it has also an elbow at its extremity, turning upwards, furnished with a collar, on which is screwed the reservoir D, its cover E being level with the paving of the street. This will be rendered more intelligible by referring to fig. 2. References as before, viz. A the main, B the projecting pipe, C C the communication pipe through which the water enters the reservoir D. In this drawing the cover is represented as being shut, but in fig. 1 open as in use. It is essential to the full perfection of this plan, that no cocks whatever, except the one marked *c* in the engravings, interpose between the main and reservoir.

In case of fire, on the arrival of an engine, the cover of the reservoir is to be thrown open, and the water turned on by means of the cock *c*, for which purpose each engine should be provided with a key. On doing this, a most plentiful supply of water would immediately fill the reservoir; within which the suction pipes of three or four engines might be laid.

If this plan were adopted, an engine might be set to work immediately on its arrival at a fire, or as soon as the hose could be attached; a parish engine, for instance, having (as they generally do) the hose ready fixed, might be

Fig. 2.



brought to bear on a fire in *one minute* after its arrival.

Before quitting this subject altogether, I feel myself bound to lay

before your readers another plan for preventing the loss of time which is at present unavoidably occupied in breaking up the street paving at fires. It is the invention of Mr. Samuel Buston, whose name has before appeared in the "Mechanics' Magazine" (see page 31 of the present vol.); and to whose inventions in the equipment of fire engines, I will endeavour to do justice in a future communication.

Mr. B. proposed, that in paving the streets, at distances of about twenty feet in the line of the canal, a square hole or reservoir should be formed, to be filled by one or more stones, of which one in the centre should form the key; which being removed, by a ring fixed in the top, or some other means for that purpose, should admit of the others being easily taken out, forming a reservoir for instantly collecting the water.

This would be a valuable improvement at a trifling expense; and I do hope shortly to see this, or some other plan, adopted, which, by placing in the hands of the firemen a plentiful supply of that weapon with which alone they can successfully encounter their powerful antagonist, will considerably diminish the number of bad fires.

Believe me, Sir,

Yours respectfully,

W. BADDELEY, JUN.

10, *George-yard,*
Lombard-st. Dec. 24*th*, 1827.

EXTRAORDINARY FEAT IN TURNING.

Sir,—Some weeks ago, I observed in a newspaper the following paragraph:—"Mr. Peter Taylor, Cabinet Maker and Turner, of Dunmow, lately undertook to turn eighteen pairs of 5-feet tent bed-pillars, top and bottom, in a workmanlike manner, within twelve hours. The pillars and his turning lathe being properly prepared the evening previous, he commenced this great undertaking a few minutes after six o'clock; and, notwithstanding the interruption of a full hour, by the iron-work of the lathe becoming so heated and swollen as to require alteration, he completed his work twenty-five minutes after five o'clock; being perhaps one of the greatest efforts of the kind ever attempted by one man."

Being in Dunmow a short time since, I called upon Mr. Taylor, and obtained a sight of the pillars, as they were turned out of his hands on the above occasion. As far as I could judge, the work was extremely well executed; neither was it of so plain a description as might be supposed, for the posts were throughout of the reeded fashion. The wood too was a hard beech, the posts being taken out of a lot of quarters promiscuously. Mr. Taylor sharpened all his own tools, and put into the lathe, took out, and centered, every pillar himself. Each pillar was collared, to render it steady, and prevent it flying out of the lathe. They were papered off in the lathe, and finished as they usually are done. The chuck being a new one made for the occasion, it heated after about one third of the work was done, and occasioned great delay and labour during the turning of the remainder.

I think an effort like this ought to be made public; for, as far as I can learn, five or six pairs are considered a full day's work, and but few can accomplish that number. That an undertaking of this kind will stimulate others to attempt the like there is no doubt; and it must be of benefit to the public, where despatch and quality in work go hand in hand. "If a man performs that which has not been attempted before, or attempted and given over, or hath been achieved, but not with so good circumstance, he shall purchase more honour than by effecting a matter of greater difficulty or virtue, wherein he is but a follower."—*Bacon.*

I have recommended Mr. Taylor to send to you some drawings of his machinery, as I consider it the most simple yet most efficacious

I ever saw, and the least liable to get out of order.

I am, Sir,
Your obedient Servant,
B. K. S

Chelmsford.

ASTRONOMICAL QUERIES.

Sir,—In answer to the Astronomical Queries (vol. viii. page 223), in respect to the obliquity of the ecliptic, I beg to refer your correspondent to the first volume of the Rev. Dr. Pearson's "Practical Astronomy," lately published. At pages 174, 175, 359, and 436, he will find correct tables of the mean obliquity, and of the solar and lunar equations to be applied thereto, for obtaining the true obliquity.

Secondly, for the reduction to the ecliptic, see also pages 204, 205, 206, 372, and 373, of the above work; also Dr. Hutton's and Professor Barlow's "Mathematical and Philosophical Dictionaries," Art. Reduction. And for tables of the reduction of the planets to the ecliptic, *vide* Bouvard's "New Tables of the Planets Jupiter, Saturn, and Uranus," published by the French Board of Longitude; "Lalande's Astronomie;" "Ewing's Practical Astronomy;" and also vol. iii. of the late Professor Vince's "Complete System of Astronomy;" in which works, tables of the reduction of all the planets may be found, except the four minor ones, lately discovered.

Astro Solis.

January, 1828.

MR. PECKSTON AND GAS LIGHTING.

Sir,—There is a passage in the preface to Mr. Matthews's "Historical Sketch of Gas Lighting," (not praised in my humble opinion more than it deserves), which throws so much light on what Mr. Peckston has advanced in your last Number, with respect to the gas meters of Mr. Clegg and Mr. Malam, that you will probably think it due to the parties concerned to lay it also before your readers. It is as follows:—

"There is one omission to which it may be proper to advert, because Mr. Peckston has expatiated on the subject in his work on gas lighting; this relates to Mr. Malam's claim to an improvement on Mr. Clegg's gas meter. After the most diligent, and, as he trusts, impartial inquiry into all the circumstances, the writer was constrained to entertain such doubts as induced him to omit the relation of it. From the information obtained, it appeared that Mr. Malam was, for a considerable time, the draughtsman in the office of Mr. Clegg, while he was engineer to the Chartered Company, and therefore became acquainted with his plans and contrivances. A *model* of the alleged improvement in dispute between them, was exhibited by Mr. Malam *only about a fortnight* after Mr. Clegg had left the Works: from the first, the latter contested the claim, and facts seemed to countenance his statements. Perhaps it ought also to be noticed, that amongst other things, Mr. Peckston attributed to Mr. Malam the *invention* of *elliptic* retorts, although they had been employed many years before; that both held situations at the Chartered Gas Company's Works, while Mr. Clegg was engineer; and as they were *brothers-in-law*, some allowance may be made for the zeal displayed by the former in favour of Mr. Malam. But circumstances render it highly probable that both derived whatever information they possessed at that time, relative to gas lighting, from their intercourse with Mr. Clegg."

I would just beg leave to add, with respect to the medal awarded by the Society of Arts to Mr. Malam, that no conclusion ought to be drawn from that circumstance in his favour and to the prejudice of Mr. Clegg, unless it can be shown (which I think I may defy Mr. Peckston to do) that the Society awarded that medal, after a due examination of the claims of *both*. I believe it will be found that the Society had no

intention whatever of passing any judgment on the rival claims of the parties.

I am, Sir,
Yours, &c.
G. T.

HEATING BY WATER.

A mode of heating, nearly resembling that which we described in our 225th Number, as having been introduced by Mr. Anthony Bacon, at Elcot, appears to have been for some time in use by Earl Powis. It is described by Mr. Manwaring, in Mr. Gill's "Repository" for November last, and consists in surrounding a small steam-pipe, of not more than two inches in diameter, with another pipe about six inches in diameter, filled with water. The water and steam-pipes surround the house to be heated in the usual manner; they are made gradually to descend from the place where the steam enters to where it escapes, in order that the condensed water produced from the steam may be conveyed back again to supply the boiler. In order to obviate the mischief that might arise from the expansion of the water to be heated, and the consequent generation of steam in the water-pipe, a cylindrical vessel, placed on end, and open at top, is connected with the pipes; and in this the water may rise and fall, according to the degree of contraction or expansion to which it may be subjected.

Mr. Loudon, in the last Number of the "Gardener's Magazine," justly observes of this plan of Earl Powis, that, compared with the simple and beautiful system introduced at Elcot, it is a much more expensive mode of effecting the same object, and by no means so certain. It has, however the historical merit of forming one step in the progress of this improved method of heating.

LONDON MECHANICS' INSTITUTION.

NO. XV.

"Truth is a thing that I will ever speak."

Wednesday Dec. 2.—Sixteenth Quarterly Meeting.

Friday 7.—Mr. Lingard on Dry Rot.

Wednesday 12.—Dr. Birkbeck, Rise and Progress of the Art of Paper-making in all it various branches.

Wednesday 19.—Dr. Mitchell on the Antiquities of Greece.

Friday 21.—Mr. Lingard on the Dry Rot.

Friday 28.—Mr. Hemmings, a member, on the General Properties of Matter.

The proceedings at the last Quarterly Meeting afford to the members a very useful lesson. It shows them the necessity of looking more narrowly into their affairs, and of managing the concerns of the Institution *themselves*. Had this been done at the time the Building Committee was appointed, it is most probable that the unpleasant, and in some part disgraceful, scene witnessed on the above occasion would have been avoided. At the time, however, of the erection of the Theatre, the members were young in business; they wanted experience: having by it gained knowledge, it is to be hoped that they will not suffer their interests to be neglected, or their affairs injured, either by negligence of their own or others. Another lesson they have also learned, and by it also they will profit;—Mr. M'William, in the course of the evening, afforded the strongest argument which has yet been adduced against gratuitous lecturing or assistance. He seemed to rest his defence on this point, viz. that the members of the Committee were not paid, and were therefore not accountable. According to this reasoning, had a surveyor been employed and paid, we should have saved a considerable some of money, as he would have been answerable for any error. Now, Mr. M'William and his colleagues having done it for nothing, are not liable, and they therefore set the members at defiance. His attack on Mr. Millington's report was wanton and unhandsome. The manly, straight forward answer of the Professor, was a complete contrast to that of Mr. M'William, and the members were not slow in expressing a very decided opinion.

The month of March will afford the members an opportunity for placing on their Committee *efficient* Vice-Presi-

dents. It is quite notorious, that out of the four, two only have performed their duty. Mr. Martineau is scarcely ever seen; Dr. Gilchrist, who, at one time, was a most zealous and constant attendant on the Lectures, has not for many months shown himself; Mr. Martineau never does. It is high time, when gentlemen become mere ciphers on the Committee of Management, that others should be placed there, who, by their activity and ability, will materially assist the Institution in its present state of necessity. The members cannot look out too early. The subject is one which requires their most serious deliberation; and the remedy for the evil is in their own power; and surely experience has taught them how to exercise their right to their advantage.

Dr. Birkbeck and Mr. Hodgskin have commenced their courses of lectures.

☞

LIST OF NEW PATENTS.

Joseph Robinson, Merchant's-row, Limehouse, in the county of Middlesex, brush maker, for his invention of an improvement in the manufacture of brushes of certain descriptions, and the application thereof to the manufacture of brushes, and other purposes. Dated 4th December. (*Six months.*)

Paul Steenstreep, of Basing-lane, in the city of London, Esq., for his invention of certain improvements in machinery for propelling vessels, which improvements are applicable to other purposes. 11th December. (*Six months.*)

John Harvey Sadler, of Hoxton, in the county of Middlesex, mechanist, for his invention of certain improvements on power-looms for the weaving of silk, cotton, linen, wool, flax, and hemp, and all mixtures thereof. 13th December. (*Six months.*)

Ralph Rewcastle, of Newcastle-upon-Tyne, millwright, for his invention of a new and improved method of ballasting ships or vessels. 13th December. (*Six months.*)

Robert Stein, of Regent-street, Oxford-street, in the county of Middlesex, gentleman, for his invention of an improvement in applying heat to the purpose of distillation. 13th December. (*Six months.*)

Frederick Benjamin Geithner, of Birmingham, in the county of Warwick, brass-founder, for his invention of certain improvements on castors for furniture and other useful purposes. 13th December. (*Six months.*)

Joseph Anthony Berrollas, of Nelson-street, City-road, in the parish of Saint Luke, in the county of Middlesex, watch-manufacturer, for his having invented or found out a method of winding up a pocket watch or clock without a key; which he calls Berrollas's Key-less Watch or Clock; and also a certain improvement, to be applied to his late invented detached alarum watch. 13th December. (*Two months.*)

John Lee Stephens, of Plymouth, in the county of Devon, merchant, for his having invented or found out a new or improved method or methods of propelling vessels through or on the water by the aid of steam, or other means or power, and for its application to other purposes. 18th December. (*Six months.*)

Thomas Tyndall, of Birmingham, in the county of Warwick, gentleman, in consequence of a communication made to him by a foreigner residing abroad, for certain improvements in the machinery to be employed in making nails, brads, and screws. 18th December. (*Six months.*)

NOTICES TO CORRESPONDENTS.

Mr. W. M. Rice, in reply to Mr. Jopling, respecting the application of the Septenary System to Naval Architecture, in our next.

Mr. De Jongh's paper is intended for insertion.

We shall write to Mr. H. of Exeter in a few days.

If "Mr. Wm. Smithers," who made the inquiry in No. 31, p. 45, will send to our Publishers, he will find a paper addressed to him.

Communications received from J. D. S.—F. G.—S. R.—Mr. Baddeley—J. S.—Vectis—An Amateur Turner—T. M. B.—Mr. Jopling; $x-1+\sqrt{-3}$; B. J.—Mr. Utting—J. Morgan—J. C. —Gamma.

Errata.—No. 228, p. 390, col. 1, line 32, for "*fifty* cases," read "*forty* cases;" p. 391, Introduction, for "Cissoid 1400 *Deroche*," read "Cissoid 1400 *Diocles*."

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

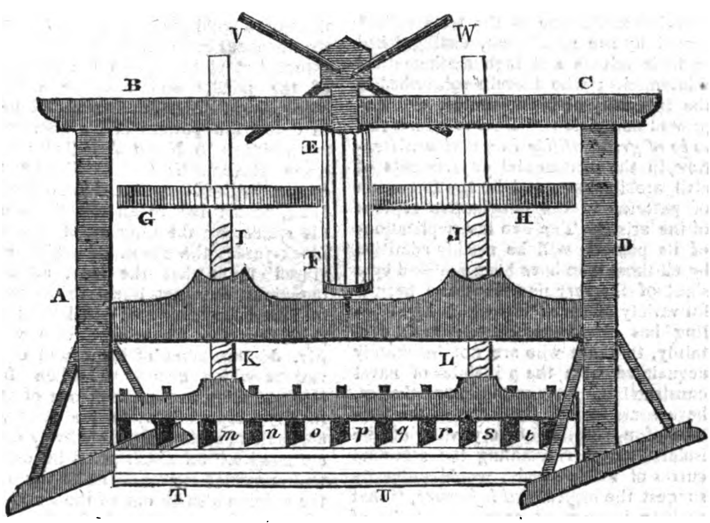
No. 230.] SATURDAY, JANUARY 19, 1828. [Price 3d.

"Oftentimes an uncertaintie hindered our going on so merrilie; but by perse-vering, the difficultie was mastered; and the new triumph gave stronger heart unto us."

RALEIGH.

SCREW PRESS FOR MAKING CLAY OR EARTH INTO MOULDS.

INVENTED BY DIXON VALLANCE.



Sir,—The prefixed drawing represents a screw press for making clay or earth into moulds, such as is required by your intelligent contemporary, Mr. Loudon. A B C D is the frame, made of cast-iron or hard wood; E F shows a long perpendicular pinion, which works the screw; G H are two horizontal wheels, one on each side of the pinion, fixed on the screws, which serve for their axles; I J are the nuts or sockets; K L a strong square piece of cast-iron or hard wood, attached to the screws, to press the earth or clay in the box. There are a number of steel or iron divisions, about the thickness of a common spade, any number of which may be fixed to make the mould of the required size; *m n o p q r s t* are the divisions fixed in K L with screw nuts; T U is the box which holds the clay or earth. There are openings or cuts in the bottom of the box, to let the cutting divisions pass through when in the act of pressure; V W shows the handspokes to work the press.

I am, Sir,

Your old Friend,

DIXON VALLANCE.

Chill November, 1827.

ON THE APPLICATION OF MR. JOPLING'S SEPTENARY SYSTEM TO NAVAL ARCHITECTURE.

Sir,—Having seen a letter from Mr. Jopling, in No. 226 of your excellent Journal, and maturely considered its subject matter, I feel desirous of making a few observations relative to that portion of it, which urges the adaptation of "the Septenary System," and the use of his newly-invented instrument, to the purposes of Naval Architecture. Permit me, therefore, to avail myself of your pages, that the validity of the question may be fairly examined through the same channel of communication.

The ground, or pretext, on which Mr. Jopling *insists* that the Septenary System must develope a perfect principle in Naval Architecture is the testimonial* signed by five gentlemen, distinguished by their talents and high mathematical attainments; who therein subscribed to the ingenuity of his apparatus, and expressed an opinion "*That it cannot fail to be of great utility in naval architecture*, in the ornamental departments of civil architecture, and in the formation of patterns in the imaginative regions of the arts." The two last applications of its powers will be readily admitted by all those who have been gratified by a sight of the very numerous and beautiful variety of specimens which Mr. Jopling has already produced; and, certainly, to those who are not intimately acquainted with the principles of naval construction, but who, nevertheless, have some idea of the forms of the timbers of a ship, a cursory view of the isolated curves resembling the sectional curves of a ship's body, would naturally suggest the *conjectural inference*, "that such an instrument cannot fail to be of great utility in Naval Architecture." But Mr. Jopling has certainly compromised the courteous intention of those gentlemen who have honoured him with such a flattering testimonial, by making them accountable for his positive opinions, contrary to the judgment of every naval architect who has examined the principles of his system. This is a very striking illustration of the great caution with which we ought to draw conclusions *primâ facie*; even when the inference (as in this instance) seems to follow irresistibly from first appearances.

Mr. Jopling will possibly accuse me of arrogating too much to myself, by disputing such high authorities. I do it with due respect, and shield myself under *their* liberality—feeling certain that their judgment will always be open to conviction, upon all questions of a scientific nature, and more especially upon a branch of science which most probably they have never had occasion to cultivate: with these premises, I shall proceed to an examination of Mr. Jopling's System, and endeavour to trace the analogy between it and the necessary elements which enter into the construction of ships; making such occasional comments on his letter, as the nature of the subjects demand.

One of the professed principles of Mr. Jopling's invention is, that it possesses the power of describing a series of curves representing the correct forms of any sections of a solid made by parallel planes, the distances between those planes being assumed at pleasure, and the formation of the middle and extreme sections being given. Mr. Jopling stated more in detail the powers of his instrument appertaining to Naval Architecture in seven *problematical* applications,* addressed to the Navy Board in November 1822, which led to an examination of his system by the Officers of Deptford Dock-yard; the result of which convinced them that the plan, although ingenious, was not likely to be useful in Naval Architecture: but I must here point out the undue advantage which Mr. Jopling takes of the casual observations which may have fallen from those gentlemen in the course of their inquiry; especially as to the utility, or application, of the instrument in "*getting out moulds*," on which point he dwells, with repeated emphasis, as having been the opinion also of one of the Surveyors of the Navy. Mr. Jopling may be assured, that the moulds alluded to had no reference to the "Mould Loft," where ships are laid down to their full size, and moulds prepared for actual building; nor can the curves exhibited by him on a small scale, be acknowledged to suit the mould, or contour of the various sections and lines on the draught of a ship; but as merely subservient to the ordinary operation of getting in curves by portions, shifting the moulds as may be necessary, to make the united line fair. There are, however, so many moulds in existence, of easy formation, well-adapted to the purpose,† and, more

* See page 357 of this volume.

* See page 360.

† One very simple and efficient method of constructing a graduated set of

over, so few required by an experienced draughtsman, that the instrument holds out no new advantage, in this particular instance, to recommend it to the notice of naval architects.

In April 1823, Mr. Jopling having published the particular properties of his instrument, and explained the nature of the "Septenary Scale," forwarded a copy to the Navy Board, together with the testimonial before quoted. Three gentlemen were, on this occasion, deputed to inquire into its merits; and from their united opinions, and the examination of various curves, subsequently transmitted, the Navy Board again informed Mr. Jopling, that his system of generating curves did not appear to be adapted to the construction of the draught of a ship.

This gentleman seems to have predetermined that his system *must* establish a new principle in ship-building; by reference to page 9 of his pamphlet, (quoted from in his letter) will be seen the following paragraph:—"Of the practicability of this system, the author is certain; and he would invite scientific gentlemen, who are more familiar than he is with the principles by which the forms of ships are regulated, to judge of its utility." Many gentlemen having met his invitation, and judged that it is of no utility for the purpose here proposed, it is surprising that he should not have yielded to their better judgment.

After further negociation, in February 1825, the Navy Board directed five of the students* in Naval Architecture, to examine the system and report thereon, (having been one of the number, I can speak most confidently as to the mode and result of this investigation). From Mr. Jopling's limited knowledge of what is essential to the construction of a ship, many particulars were pointed out to him, as data for his guidance; and the students, as a further preliminary, obtained from Mr. Jopling "a familiar acquaintance with the principles and modes of application of his instrument." The system was then submitted to the test of trial, by an actual example, on the lines of a 74 gun ship; after a most patient and fair examination of the principles, and numerous trials to produce the body plan only, it was unequivocally found to be inadequate to the purpose. It will not be necessary to enter into detail here, or to exhibit explanatory diagrams to show the differences between the original, and the plan generated by the instrument in *this* example; hoping, in the course of this inquiry, to give ample *general* reasons to satisfy Mr. Jopling's mind, of the justice and consistency of the many professional decisions that have been given against his system. Mr. Jopling proposed to classify the different varieties of curves produced by his instrument, and to register their respective adjustments; so that at any time they may be reproduced, and made available to Naval Architects.

It may be satisfactory to give a few reasons why the principles of Naval Architecture are not compatible with this system: the body of a ship, although symmetrical, is not conformable to purely geometrical construction; but varies in its contour from physical causes, connected with the properties and qualities under all its motions and evolutions at sea; and to produce the lines of a good ship, or to proceed with tolerable prospect of success (something more than a system which tends only to trammel the ideas of the constructor must be resorted to), the judgment must be submitted to the unerring laws of mechanics and hydrostatics.

It can be shown, by analogy and mathematical reasoning, why this instrument must, upon its *own* principles, fail in tracing the ordinary forms of the sections of ships; and it would be a daring and dangerous speculation to depart materially from those forms which long experience and the aid of science have as yet produced, without some very sure grounds to go upon. To proceed: the curves exhibited by this instrument are generated upon the principles of rectangular co-ordinates, and referable to *geometrical* construction, whose equations may be determined from the adjustments of the instrument and conditions of motion, and all the possible forms of cissoid and conchoid developed and submitted, by investigation, to certain formulæ. A slight analogy exists in

moulds, was invented by Mr. T. Wilson, of the Navy-Office.

* The readers of the "Mechanics' Magazine" will no doubt have noticed the invidious manner in which *Italics* are introduced into Mr. Jopling's letter; it may, therefore, be justice to those *Students* to mention, that at that period most of them had left the establishment at Portsmouth six or seven years, and were only thus designated from not having received permanent appointments, owing to the reductions in the service to the peace establishment.

this fact—that the bow sections of some ships approximate very nearly to a class of conchoids; and the instrument might, possibly, after repeated trials, be made to trace them with tolerable precision, by one or two adjustments; but, on approaching the midship sections, all analogy between the sectional curves of the body and algebraic curves ceases; and the instrument is no longer "capable* of describing the sections by continuous motion from the top to the keel," or even of approximating to small portions of them successively, without much trouble, arising from many tedious and uncertain adjustments; and it will be shown hereafter, that an insurmountable practical difficulty enters upon the method of reproducing the united curves, even supposing the positions of the poles have been registered with perfect correctness.

Giving Mr. Jopling every possible credit for the originality and ingenuity of the idea of registering curves for the naval constructor, it is to be lamented that facts are so much against his sanguine expectations. From the nature of the arbitrary curves bounding the planes, which may be made to cut the body of a ship, they could only be remotely referable to transcendental equations; and it is impossible to form any classification of the curves which might approximate to the conditions of these equations, for such curves possess no generic properties: but for algebraic curves, such as may be generated by Mr. Jopling's instrument, the means of classification are obvious; they possess general properties, which may be discovered according to the adjustment of the poles, by algebraic equations; which method must manifestly be better suited for even *speculative* inquiry than the inductive method, or rather, method of trial and error, suggested by Mr. Jopling. The algebraic equation of a curve line indicates the different paths of the focus of the generating point with such certainty and precision, that the sinuosities and inflections of any line will be as manifest to the eye of the analyst as if defined geometrically in a diagram; therefore a table of formulæ would be much more comprehensive than the exhibition of ten thousand curves, which would only tend to confuse the mind, and distract the eye. An exhibition or registry of curves for "Gothic architecture"—for "spirals, ornamental vases, and for patterns in the imaginative regions of the arts," carries consistency with it, but is incompatible with the legitimate principles of the science of Naval Architecture.

I will now call Mr. Jopling's attention to several *practical* difficulties in the *modus operandi*, evinced in the application of his instrument to the example before mentioned upon the draught of a 74 gun ship. He will remember that not a single curve was produced with coincident precision, even towards the extremities of the ship, where the sections are favourable to the instrument; and that the midship section could not be traced, even in small portions, successively, without several adjustments of the poles, and, at the same time, cutting the original line in many points; giving undue convexity in some parts, and producing flatter or less convex curves in others than are admissible in the elements of construction: but admitting, for argument's sake, that a facsimile of the section has been generated, and that the various adjustments of the poles of the instrument have been correctly registered, there would still be much difficulty in retracing the steps by which the aggregate curve had been produced; for not only have the poles been shifted at each step, but the plane of revolution, and consequently the *axes* of the curves also, have been changed in position; in order, therefore, to get the relation between the plane of the paper, and the position of the generating point, some further guide became necessary: this Mr. Jopling effected by producing the successive axes of the curves upon the plane of the paper, both above and below the moving plane; but not unfrequently these portions of the axes went beyond the limits of the paper; at other times the plane of the paper was moved, whilst the generating point remained at rest—a mode of operation not at all convenient, or practicable for a drawing board, and quite out of the question on the Mould Loft floor. Under the most favourable circumstances that this plan could be available, it would be necessary to number each portion of curve in every section, and also the positions of the corresponding axes, to be preserved in registry with the relative situations of the poles; thus the draught would be confused with numerous lines of construction and references, irrelevant to the plan, and leading to much trouble, uncertainty, and incorrectness. How this system could possibly be extended to the "sheer and half-breadth plans," I am utterly at a loss to conceive: for the law of

* Mr. Jopling's first conditional property of his instrument.

geometrical analogy between the sections produced in the body-plan has been disturbed by isolated curves and varying axes; and therefore the sections cutting the body in oblique or horizontal directions, cannot bear the least affinity to any regular algebraic curve, and hence could not be generated by this instrument, or any trammel whatever. I will endeavour to explain the truth of this inference by an example:—Take, for simplicity, a cone, generated by the revolution of a right-angled triangle about its perpendicular side, as an axis; here all sections passing through the centre of the cone to any part of the base, produce triangles; sections parallel to the base exhibit circles; and other sections, with certain relations to the sides and base of the cone, produce ellipses, parabolas, and hyperbolas. And since the law of generation is manifestly invariable, and the solid, geometrical, the curves produced by any number of sections will be governed by invariable laws, and may either be ascertained by algebraic equations, or generated* by Mr. Jopling's instrument: but if, instead of a constant triangle and fixed axis, we take a variable figure, and a changing axis, without regular laws of variation, the solid produced could not be subjected to analysis, nor would any sections of it be tangible to the powers of this instrument. To recapitulate the grounds upon which I shall conclude, let me premise,

1st. That Mr. Jopling's instrument is capable of generating an infinite variety or algebraic curves only.

2d. No algebraic curve can partake of arbitrary transitions, through various sinuosities and inflections.

3d. The sections of ships must necessarily be arbitrary curves, depending on physical causes.

If Mr. Jopling should be satisfied that my previous arguments will maintain the above *Lemmas*, he will naturally yield to the following deductions:—

1st. That the sections of ships, or lines appertaining to Naval Architecture, cannot be described by Mr. Jopling's instrument.

2d. That every original series of curves that may be consecutively developed by mechanical contrivance, must be incompatible with the legitimate principles of Naval Architecture.

But should Mr. Jopling dispute the validity of these deductions, I may with certainty state,

* See the last paragraph but one of Mr. Jopling's letter.

Finally, That numerous *practical objections* would render the instrument abortive for the purposes of Naval Architecture, under the most rigid strictness of theoretical perfection.

Having dwelt at such length on the principal object of this communication, I should be induced to close my letter, but that I feel myself bound to reply to several allusions and insinuations, which come in a very uncourteous manner from Mr. Jopling. He insinuates that two of the students of Naval Architecture, who had some knowledge of his system beforehand at Deptford, entered upon an inquiry (instituted in February 1825), with three of their colleagues, with undue bias or prejudiced minds. It may, with truth, be said, that no such feelings existed with any one of the five, and *all* were much disposed to forward Mr. Jopling's views; anticipating every professional question, and affording him every assistance in their power.

Mr. Jopling's allusion to the remuneration made to the students, conveys at once an exaggerated *account*, and an unjustifiable reflection on the Navy Board, whose prerogative it is to remunerate any public servants under its control, according to the usage of the service, for duties which may call them from their ordinary avocations.

Mr. Jopling gives a very specious account of the conclusion which the five students in Naval Architecture came to after their examination of his principles, &c.; stating, that they were not unanimous in their opinion. The fact is, four out of the five gave a united report, awarding to Mr. Jopling the meed of praise due to him for his ingenuity, and partially viewing his instrument as productive of "speculative research;" but the fifth rejected the application of the instrument, *in toto*, as perfectly unavailable for even the *speculative inquiries* of the Naval Architect.

For the credit of naval draughtsmen, I beg also to correct an error promulgated by Mr. Jopling in his "Sixth Statement" of the powers of his instrument, which runs thus:—"The forms of the frames drawn by continued motion to resemble those required, will, nevertheless, be different to those curves drawn in the usual way; as a curve formed by putting together sweeps of different circles, must have *indents* or *elbows where the different sweeps meet*; whereas a varying curve, drawn by continued motion, has a constant and imperceptible change."

Mr. Jopling admits that he is ignorant of the physico-mathematical principles

of construction; and the above "statement" proves that he is not even acquainted with the nature of the mechanical operation of preparing a draught. The system of "sweeps" has long been discontinued. This barbarous practice of trammelling the ideas of the constructor has been wisely exploded at the Navy Office School of Naval Architecture, and no doubt by most private ship-builders of any celebrity; but I cannot fancy that any draughtsman could ever have been so unskilled in his profession as to have formed "elbows, or indents," in the union of circles of different radii: the centre of each succeeding arc, being always found upon the direction of the preceding radius, must have produced a fair union of curvature; or a tangent at the point of meeting would be common to the arcs on both sides. Every civil engineer knows the truth of this, in the construction of the battens of wharf walls, basins, culverts, &c.

One of the principal and earliest aims of a naval architect is to produce a "*fair body*;" and he must be a very inefficient draughtsman not to arrive at this point, after a very little practice with the drawing-pen, and a *few* moulds.

Mr. Jopling reflects censure, indiscriminately, on the whole body of naval architects of this country, for their tardiness in believing that his instrument is capable of establishing new principles in their profession; and whilst conditionally inviting them to judge of its utility, confesses he is ignorant of the present system, yet will not believe many united professional opinions, that his system is fallacious both in the principle and practice of naval architecture. It requires some resolution of mind to drop a favourite scheme, or to dislodge preconceived opinions, which have been reared with infinite trouble and fond expectations; but common sense should sometimes guide us: *the partial judgment of one should yield to the honourable and impartial judgment of the many*.

I am, Sir,
Your obedient Servant,
WM. M'PHERSON RICE.
H. M. Dock Yard, Chatham,
December, 1827.

THE HACKNEY INSTITUTION.

Sir,—I have been informed by one of the members of the above Institution, that a party of *gentlemen*, or rather of the *better sort of tradesmen*, who are members, have combined together, and have at a recent meeting carried into effect resolutions which are both arbitrary and unjust. He tells me that they, being the stronger party, have been the means of the name of the Institution being changed from that of "The Hackney Literary and Mechanic" to that of "Literary and Scientific Institution;" and not only so, but, by another resolution, the quarterly payments have been arranged in such a manner, that if a *mechanic* should—through misfortune, or any other cause over which he has no control—not be able to continue his subscription for *one quarter*, he cannot enter on the next unless he pay his arrears; and, if he ceases to pay for *two quarters*, he must pay 7s. 6d. in addition to the two quarters' subscription. So, I think, we may conclude, from this conduct on their part, that it is their intention, as soon as a convenient opportunity offers, to exclude those for whose benefit and improvement, and by whom, it was first established.

Now, I would ask, what reasons do they assign for making these alterations? Why deprive the humble mechanic of the little benefit which it was his good fortune to enjoy—that of useful instruction at a cheap rate?

If it should be urged by them, as an excuse, that the mechanics would not avail themselves of the offered benefits, I would answer, that it is my firm belief that this is not the case; and that if the mechanics generally could afford to keep up their payments, they would not fail to do so. The times have, of late, been so perilous, work so scarce, and, added to these, their wages so low, that many have had enough to do to satisfy the calls of nature: and this is not confined to one, two, or three Institutions: it is the case with all of them, even with the parent herself, of which I have the honour to be a member. *Apropos* of this last, I think it well to state, that ever since the half-crown entrance-fine has been laid on, we, as a body, have been greatly on the decrease.

I think the more wealthy mem-

bers of the Hackney once-valuable Institution, would be doing themselves an honour, and the poorest members a kindness, if, instead of attempting to oppress them, they were to agree to appropriate an extra five shillings in the course of a year each, and instead of raising in any respect the subscriptions of mechanics, they were to *reduce them* five shillings a year.

Let me intreat them to make a speedy repeal of the above-named resolutions, as I am fully persuaded no good can possibly result from their present manner of proceeding.

I am, Sir,
Yours, &c.
Y

ASTRONOMICAL QUERY.

Sir,—With regard to the inquiry of Rus Astro, (vol. viii. page 175,) not only himself, but your Carmarthen Correspondent, and Astro Solis (pages 223, 224), are also in error, in stating, as they do, that the difference of longitude *must* be obtained from the difference in *mean solar* time, and never from either the *apparent* or *sidereal* time.

Now, Sir, the fact is, it may be taken in any kind of time under the two meridians; for, a complete revolution of any particular kind of time, from meridian to meridian, is supposed to be divided into 24 equal parts, which may be called hours: hence, in sidereal time, 23 h. 56 m. 4 s. are divided into 24 equal parts, in order to get an expression in that time; or, perhaps, it might be clearer to say, that a clock adjusted to go *sidereal* time, must pass over 24 hours in the *mean* time of 23 h. 56 m. 4 s.; consequently, at any supposed *absolute* moment, there will be the same difference of time under two meridians, whether stated in *mean* or in *sidereal* time. Again: there is the same difference between the *mean* and the *apparent* time, at the same *absolute* moment, under any meridian; that is, the *equation of time* is the same, at the same *absolute instant*, on all parts of the earth: therefore the difference in time remains the same, whether the mean times be or be not reduced to apparent time. And the same holds good with respect to sidereal time, though it *appears* to have occasioned a difference by the reduction of Rus Astro (page 175); I say *appears* to have occasioned, because I intend to show that his reduction has not been properly made. He has merely added to the mean time, 6 h. 34 m. 15 s. its proportionate part of 3 m. 56·55 s. in 24 h.; viz. 1 m. 4·77 s., which gives 6 h. 35 m. 19·77 s. for the corresponding sidereal time; but the sun's mean right ascension at mean noon ought likewise to have been added, viz. 23 h. 11 m. 58 s. which gives 5 h. 47m. 18 s. for the sidereal time at Greenwich; and a similar process would give 13 h. 19 m. 28 s., for the sidereal time at the second meridian; and consequently the longitude comes out the same in both cases.

I am, Sir,
Yours, &c.
VECTIS.

Ryde, Jan. 1, 1828.

SHORT METHOD OF FINDING THE CONTENTS OF A PARALLELOPIPED IN BUSHELS.

Sir,—There is a short and easy way of finding the contents, in bushels, of floors, cisterns, binns, &c. &c. which is very little known, and which I therefore send herewith.

The common method is to multiply the length, breadth, and depth into one, and divide the product by 2150,42; the quotient is the content in bushels.

The shorter or new way, is to multiply the length, breadth, and half the depth into one, and that product by 7, placing the hundreds of this line under units of the line above; then subtract it from the line above, and cut off three figures, as decimals, to the right hand: this line shows the contents.

Example in both ways.—Given, the length of a floor 408, breadth 324, and depth 12, inches; required the number of bushels it contains.

Old Method.

```
        324
        408
       ----
       2592
      12960
     ------
     132192
         12
     ------
2150,42)1586304(737·6+ Ans.
        1505294
        -------
          810100
          645126
          -------
          1649740
          1505294
          -------
           1444460
           1290252
           -------
            154208
```

New Method.

```
     324
     408
    ----
    2592
   12960
  ------
  132192
       6
  ------
  793152
   55520 64
  ---------
Ans. 737,632
```

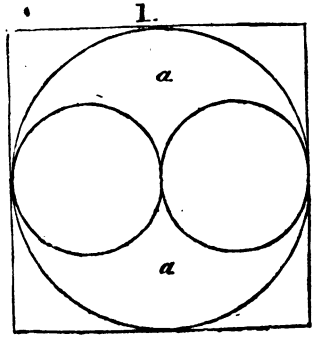
The analysis of the above will, perhaps, afford amusement to your more scientific readers.

I am, Sir,
Yours, &c.
S. C.

GEOMETRICAL PROPORTIONS.

Sir,—Your correspondent, F. B. (No. 228, p. 193), signifies his abhorrence of algebra, and requests a solution of his geometrical problem in "plain English." I have no doubt that some of your mathematical friends will feel inclined to *figure* away, to the amusement of those who understand them, in order to show that the diameter of a circle twice that of another is more than double the area of that circle. Now, without doubt, a knowledge of algebra will enable a person to answer questions of this sort more readily; but I think we can show them, without a knowledge of that science, how to solve the present one in a manner that can be understood by all parties.

1.



2

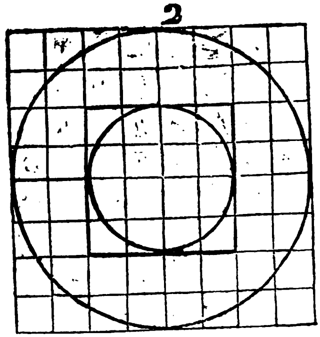


Fig. 1 is a circle enclosing two others of half its circumference; *a a* the space gained.

Fig. 2 shows the exact quantity gained. The number of squares contained in the square of the large circle are 64; those in the square of the smaller one, 16; therefore the large circle (which is exactly twice the diameter of the smaller one), contains 48 parts more than the latter, or 3-4ths. "Monsieur Simpleton" would therefore have had to deliver forty gallons instead of twenty.

I hope I have now answered the question without the aid of algebraic

symbols," to the satisfaction of our friend, F. G.; and I shall conclude by wishing he may never be — a beef steak when he is + a good appetite.

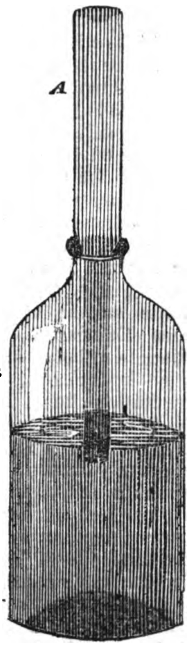
J. D. S.
Waterloo Road.

An answer nearly similar has been received from J. S. Mr. Dowling has favoured us with an algebraic solution; which, to show how little reason there is to have "a horror" of algebra, we shall give in our next.—EDIT.

HYDROSTATIC PHENOMENON.

A

B



Let A be a glass bottle with a slender neck, slightly corked, inverted and placed in the vessel B, containing water the level of which is a little above the rim of the bottle A.

In a short time the water will rise in the neck of the bottle A, considerably (comparatively speaking) above its level.

The entrance of the water into the bottle being but partially obstructed by the cork, it would rise to its level by the laws of fluids, and above it, indeed, as high as the top of the cork, by the force of capillary attraction; but how it should rise higher, I am at a loss to say. It appears, however, to depend either wholly or in part on atmospheric pressure; for if an open tube be made use of, the experiment fails. I should observe that the water attains its maximum of height in about twenty minutes.

HENRY H * * *.

HEATING BY HOT WATER.

Sir,—Observing in your last month's Magazine a new mode recommended for warming hot-houses, green-houses, &c. by substituting hot water for steam, or air heated in the usual manner by flues, I should be glad if the gentleman who invented this new process will inform me, through your valuable Magazine, if his process is applicable to purposes where higher degrees of temperature are required, such as heating stoves for drying wool, cloth, silk, cotton, &c., where a temperature of 80° to 100° is sometimes wanted; and if so, what plan he would advise for arranging the boiler, pipes, &c. For instance, suppose I require a room 40 feet long, 12 feet wide, and 8 feet high to be heated to 100°, what size should the boiler be to effect this? and what should be the number and size of the cast-iron pipes, *and how should they be arranged?*

I am well aware that steam has been for some years used for the purpose of heating hot-houses, stoves, &c.; but there is one great objection to it, which operates very powerfully against its more general adoption; which is the difficulty of keeping up a regular temperature during the night, without a person constantly in attendance on the fire, to keep the steam up; which if not done, condensation takes place, and the pipes begin immediately to cool, and the hot-house, or stove, can receive no further accession of heat till the pipes are again filled with steam. If, therefore, the new plan

of heating by water can be applied to purposes where high temperatures are necessary, without the necessity of frequent attendance on the fire, I think it will prove a valuable discovery, and will, no doubt, in a short time, be very generally adopted.

I remain, Sir,
Your's, &c.
CALORIC.

Bath, Jan. 12, 1828.

STEAM CARRIAGES.

"Soon shall thy arm, unconquered steam! afar
Drag the slow barge, or drive the rapid car;
Or on wide waving wings expanded bear
The flying chariot through the fields of air."

DARWIN.

For a considerable time past, nothing has more occupied the attention of mechanical inventors than the application of steam power to the propelling of carriages on land; and every now and then as some individual, more successful or sanguine than his fellows, has imagined that he had at length accomplished this great desideratum, there has been a prodigious stir about the great feats which were on the eve of being exhibited. Three years ago, the wonder of the day was a learned Dane, of the name of Broemark, who was said to have constructed a steam-carriage which could be "guided easily," and travel at the *moderate* rate of "*fourteen leagues an hour.*" He was reported to have visited Copenhagen in this wonderful vehicle, and to have it in intention to surprise the European capitals in succession; but, from that day to the present, nothing more has been heard, either of M. Broemark, or of his vehicle. Next, there was the American, Dr. Buchanan, who made a trial of a steam-carriage in the streets of New York, and moved it at the rate of three or four miles an hour; and "but for an unfortunate disproportion in the machinery," as the cause of his failure was gently styled, would have "completely succeeded." Then came another American, of the name of Parker, who exhibited, somewhere in the state of Illinois, a model which, "in the opinion of all who examined it, could not fail to operate well;" and was, to all appearance, perfectly faultless: it was to propel carriages on any good turnpike-road as readily as horses, and be equally manageable up hill and down. But though the United States seemed thus to have a double chance of outstripping all other countries in this field of improvement, it is certain that a travelling steam-coach is still as great a novelty there as it is everywhere else. In the autumn of 1825, a Mr. Burstall, an Englishman, gave the British public strong reason to hope that he would be able to secure to his country the honour of first substituting steam for horse-power on land. He contrived an engine for the purpose, of which there is a very full description, with illustrative drawings, in our fourth volume, pp. 391, 433, and which was spoken of at the time in the highest terms. One trial with it was made on the Queensferry Road, near Edinburgh, when it went at the rate of between five and six miles an hour; but, lest the public expectation should be cooled by so indifferent a report of its capabilities, it was considerately and very gravely added, that "a greater velocity might have been given to it, *had not a slow motion been necessary to observe the working of the machinery.*" Another trial of Mr. Burstall's coach—much improved, it was said, in all particulars—was made on the Westminster Road, London, in the course of last summer; or rather, we should say, *about to be made*—for as it was on the point of starting, the boiler burst, and two or three persons in attendance upon it were severely injured. The next Englishman who appeared in the field was Mr. Brown; for though the source of power in his engine is not steam, but gas, it works, as the steam engine does, by means of a vacuum obtained, and in a manner so nearly

similar, that it is not worth while separating him from the list of those who are endeavouring to supersede the use of horses by this description of locomotive machinery. A four-wheeled carriage, propelled by means of one of Mr. Brown's engines, was tried on Shooter's Hill, in June 1826, and was said to have "surmounted it with considerable ease." But though this was undoubtedly surmounting a great deal, (an ascent of about 13½ inches in 12) and made it seem past doubt, that, on all tolerably level roads, gas-engine stage coaches would be immediately substituted, nothing of the kind was witnessed, and the public were fated to have their expectations again disappointed. From this period, the public heard no more of steam or gas carriages (if we except the *explosion* of Mr. Burstall's machine on its second trial) till about the close of the year just expired, when Mr. Goldsworthy Gurney, the patentee of a steam engine on the tubular plan, and author of "Lectures on Chemical Science," certified, by a letter from himself to to the Editor of "The Times," that he had made trial of the powers of a steam carriage of his construction against Highgate-hill, which it ascended at the rate of between three and five miles an hour; that he was afterwards induced to take it through Highgate Town, and along the Finchley Road, when its speed was increased to the rate of "fifteen miles an hour;" that as he was descending Highgate Hill on his return, one of the back wheels, which had been badly made, broke down; but that otherwise, no accident could have happened, the whole machinery weighing only eight cwt. and being perfectly under control. Mr. Gurney afterwards exhibited his engine several times in the Regent's Park, and so certain did he feel that he had overcome every obstacle to its general adoption, and such was the confidence in its powers with which he had inspired others, that contracts were entered into for introducing it on most of the principal roads throughout the kingdom; and but little doubt was entertained that by the 1st of January, 1828, steam coaches would be actually running on one or more of them. It is now, however, the 15th of January, and no steam coach is yet in active operation any where, nor, from all we can learn, likely to be soon. Mr. Gurney, like all his predecessors in this field of invention, has found, in the eleventh hour, that there is still an important something wanting in his arrangements to insure success; nor is it improbable, that while he is endeavouring to remedy the defect, some luckier genius may step in, and carry off the laurel that will justly be earned by him who first enables us to make steam as efficient a mover on land, as it is already on water.

In the preceding retrospect, we have noticed those attempts only which have come prominently before the public; but, besides Mr. Burstall, Mr. Brown, and Mr. Gurney, we could name at least a dozen more individuals who are all earnestly striving to accomplish the same thing. About three months ago, there was a correspondent of our own—a gentleman whom we believe to be alike respectable for moral integrity and inventive talent—who announced (No. 216, p. 199) that he had completed a steam engine on a new principle, which did not weigh *more than 30lbs. per horse power*, and that he was engaged in applying it to a carriage which, "from the result of experiments he had made, he felt no hesitation in asserting he would be able to propel at the rate of ten or twelve miles an hour."

The conclusion we would draw from all these facts, is one far from unfavourable to the hopes of the public. The fact that so many individuals have touched so nearly on the point of perfect success, and are still persevering in their efforts, furnishes, we think, every reason for believing that it will be attained by some one or other, sooner or later. The disappointments, however, which have so repeatedly taken place, ought to teach the public to be slow in giving credence to any of the sanguine representations which

are daily sent forth on the subject—to any thing, in fact, short of the actual establishment of stage coaches propelled by steam; and will, we trust, serve to justify us with our readers for not prematurely filling our pages with descriptions and drawings of engines, either not perfected, or existing as yet only on paper, or in models. We ourselves saw Mr. Gurney's machine when in a rude state, at his factory, several months ago, and might at that time have given some account of it, had we not been restrained by a conviction, that in doing so we should be acting unfairly towards Mr. Gurney, and serving those only who are competitors with him in the same line of invention. But had we even disregarded these motives for silence, we are certain that we could never with any respect for truth, have presented our readers with such *fine pictures* of this engine as are now everywhere to be seen. We believe we may safely venture to assert, that no such thing as a steam coach, complete in all its parts, has yet been seen by any living soul. The carriage exhibited by Mr. Gurney has the appearance of a common break—nothing more.*

In our next we shall offer some observations on the theory of applying steam to land carriage, and on the obstacles which are supposed to stand in the way of its accomplishment.

THE THAMES TUNNEL.—ANOTHER AND MORE FATAL IRRUPTION OF THE RIVER.

It will be in the recollection of our readers, how repeatedly and earnestly in the course of the last six months, we represented the impropriety of proceeding with this work until some means were taken to protect it from any more irruptions of the river. When we first noticed the accident which took place on the 18th of May last, we observed, (Mech. Mag. No. 198) "An important question which we have heard some of the subscribers put on the subject is this—Can we be sure that this is the only hole we shall have to stop up in the progress of the work? In the case of the drift which was made under the Thames, and not far from the same spot, in 1809, it was twice stopped by the irruption of quicksands, and finally abandoned when within 100 feet of being concluded. The present tunnel has been interrupted before it has advanced more than one-third of its proposed length, (1300 feet); and as the crown of earth *must be expected to diminish* in thickness towards the centre of the river, *there seems every reason to apprehend a frequent recurrence of the present disaster.* It would be well, therefore, if those who direct their attention to the subject would not confine themselves to the means of stopping this one leak, but think of some plan by which such works *might be protected from inundation throughout the whole of their progress.*" And still more recently (See Mech. Mag. for Oct. 13, 1827) when reviewing a small work entitled, "Sketches and Memoranda of the Works for the Tunnel under the Thames, published (after the former accident), and sold *at the Tunnel Works*, Rotherhithe," we reverted in the following more explicit terms to the danger to be apprehended:—"A superstratum of even 14 feet furnishes but little ground for confidence, where holes of such depth occur, (as 9 and 17 feet). Mr. Brunel would do well to trust to *something else* than the thickness of the ground over head, if he expects to bring his undertaking to a successful conclusion. We have before pointed out the expediency of adopting some sort of artificial shield, *that shall secure the works from inundation throughout the whole of their progress,*

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* To such an extent has the catering for public curiosity on this subject been carried, that after one Sunday newspaper had given a *fancy sketch* of Mr. Gurney's carriage, "as it appeared in the Regent's Park," another (determined not to be outdone) gave, on the following Sunday, an exact drawing of THE *Steam Coach that is to run between London and Edinburgh!*

whatever may be the nature of the soil cut through. And we are sorry not to find in the publication before us, the least assurance that any plan of this kind is in contemplation. Mr. Brunel seems to think it enough that he has succeeded in stopping up one hole, to justify him soliciting his constituents to go along with him in running every risk of a second."

It was with no surprise, therefore, though with abundant sorrow, that we read in the newspapers, that on the morning of Saturday last, the 12th inst. when 130 men, under the personal direction of Mr. Brunel, jun., were proceeding in the work of excavation, the water once more rushed in so suddenly, with such violence, and in such abundance, that six men lost their lives, and it was only with the greatest difficulty, and by the greatest good fortune, that the rest escaped a similar fate. The following is Mr. Brunel, jun.'s, own account of this melancholy affair :—

"*Saturday Morning, Jan.* 12.

"I had been in the frames (shields) with the workmen throughout the whole of the night, having taken my station there at ten o'clock. During the workings through the night no symptoms of insecurity appeared. At six o'clock this morning (the usual time for shifting the men), a fresh set or shift of the men came on to work. We began to work the ground at the west top corner of the frame. The tide had just then began to flow; and finding the ground tolerably quiet, we proceeded, by beginning at the top, and had worked about a foot downwards, when, on exposing the next six inches, the ground swelled suddenly, and a large quantity burst through the opening thus made. This was followed instantly by a large body of water. The rush was so violent as to force the man on the spot where the burst took place, out of the frame (or cell), on to the timber stage behind the frames. I was in the frame with the man; but upon the rush of the water, I went into the next box (or cell), in order to command a better view of the irruption; and seeing that there was no possibility of their opposing the water, I ordered all the men in the frames to retire. All were retiring except the three men who were with me, and they retreated with me. I did not leave the stage until these three men were down the ladders of the frames, when they and I proceeded about twenty feet along the west arch of the tunnel; at this moment the agitation of the air, by the rush of the water, was such as to extinguish all the lights; and the water had gained the height of the middle of our waists. I was at that moment giving directions to the three men in what manner they ought to proceed, in the dark, to effect their escape, when they and I were knocked down and covered by a part of the timber stage. I struggled under water for some time, and at length extricated myself from the stage; and by swimming, and being forced by the water, I gained the eastern arch, where I got a better footing, and was enabled, by laying hold of the railway rope, to pause a little, in the hope of encouraging the men who had been knocked down at the same time with myself. This I endeavoured to do by calling to them. Before I reached the shaft, the water had risen so rapidly that I was out of my depth, and therefore swam to the visitors' stairs, the stairs for the workmen being occupied by those who had so far escaped. My knee was so injured by the timber stage, that I could scarcely swim, or get up the stairs; but the rush of the water carried me up the shaft. The three men who had been knocked down with me were unable to extricate themselves; and, I am grieved to say, they are lost; and, I believe, also two old men and one young man, in other parts of the works."

The following additional particulars are furnished by the newspapers.

"The noise created by the influx of the waters was tremendous, and absolutely deafened the ears of those engaged at the base of the shaft; indeed it was so powerful, that the water rose several inches above the level of the shaft."

"At one period, about eighteen men were immersed in the water, besides Mr. Brunel, junior; and that gentleman and twelve of the men, after being repeatedly driven against the woodwork, and severely bruised, were taken out of the shaft nearly insensible."

"The works, of course, are stopped."

"At twelve o'clock last night (Sunday), Mr. Brunel, accompanied by Mr. Gravat, assistant engineer, made a descent in the diving-bell, near to the (new) aperture, and found that it *measures from seven to nine feet in length, and between four and five feet in breadth.*"

—(The depth is not mentioned; but it cannot be less than 10 or 12 feet.)

We have no wish to say any thing that may be considered as bearing harshly on individuals who must be supposed to entertain already no ordinary sorrow for this lamentable catastrophe; but there are interests at stake, which seem to us to demand that no motive of mere delicacy should be suffered to stand in the way of an honest and fearless exposition of the causes which have led to it. We would put no stress whatever on the pecuniary interests involved in the undertaking; neither would we claim more respect for the memories of the unfortunate workmen who have perished on this occasion, and for the feelings of their bereaved relatives, than usually falls to the lot of the poor and humble; all that we have to ask is, that due regard shall be shown for *the many more lives* that may be endangered in the prosecution of this undertaking, by a perseverance in the same mode of proceeding which has just proved so fatal. But few of the poor men who engage in labours of this sort are able to judge of the extent of the danger they encounter: it is enough for them that they find men of reputation and substance, like Mr. Brunel, willing to brave the same danger along with them. It is the more necessary, therefore, that some one should care for those who take no care of themselves. In the present instance, only six lives have been lost (we speak of course comparatively); but should another gang of 130 men be again set to work, with no other protection than was provided for them on Saturday morning last, the chances are equal (at least), that instead of six, every soul of the number will perish.

Two leading general facts may be considered as beyond dispute.

First, That after the former aperture was closed up, the work of excavation was recommenced without any step having been previously taken to protect the remainder of the ground overhead from the irruption of the water; *although the necessity of such a precaution was repeatedly pointed out, and although it is certain that such a shield or covering might have been dropped into the bed of the river, as would have absolutely prevented the recurrence of any such disaster.*

Secondly, That not merely was the rest of the line of excavation unprotected by any superincumbent shield or covering, but that so carelessly was the ground in advance of the last aperture sounded, that, before the workmen had proceeded much farther, they were stopped by a hole from 7 to 9 feet long, between 4 and 5 broad, and from 10 to 12 feet deep! It is clear, that had the bed of the river been as minutely examined as *it might and ought to have been*, Mr. Brunel and his men would never have blundered on so fearful a gap as this.

The line of duty which these facts point out to the Directors of the Thames Tunnel is plain. Let it be *their* care that no more lives are wantonly risked. Let them, on no account whatever, permit the excavation to be again proceeded with, until they have perfectly satisfied themselves that effectual means have been taken to keep out the water; and let them, in furtherance of this purpose, not again rest contented with what their own engineer and his assistants may represent as sufficient, but withhold their permission to proceed, until they have been assisted by the opinions of three or more engineers of competent ability, and wholly unconnected with the concern.

Before closing these remarks, we must not omit to notice, with the praise it deserves, the manner in which Mr. Brunel, jun. conducted himself at the moment of this last unfortunate disaster. If any thing could throw into the shade the foolhardiness which placed him in the front of the danger, it would be the coolness and resolution with which he encountered it, and the humane concern which he evinced for the safety of the unfortunate workmen under his charge.

ENGINEER'S POCKET-BOOK.

Among the new Pocket-Books for the present year, there is one by Mr. Henry Adcock, Civil Engineer, which we have great pleasure in bringing under the notice of our readers. It is specially designed for the use of "Engineers, Architects, Manufacturers, Millwrights, and Builders;" and is the first thing of the kind which has yet appeared. In addition to the matter common to other Pocket-Books, such as ruled pages for memoranda, List of Stamp Duties, &c., it contains no less than *four hundred and thirty-five* Tables, Rules, and articles of information connected with Practical Science; and a vast number of illustrative wood-cuts. The Tables, Rules, &c., are in general of a very useful description, and such as practical men will find it a great convenience to be able to refer to, without having recourse to their libraries. There are a few which seem to be not so suitable to a work of this description, such as the A B C of geometry, decimal fractions, &c. We look, in a *vade-mecum* like this, not for the elements of science, but for its results. Of the accuracy of such a large body of facts and figures, we cannot of course be expected to speak; but we observe that the author gives, almost always, his authorities, and, in a prefatory notice, expresses his obligations to Dr. T. Young, Dr. Birkbeck, Dr. Kelly, Mr. Peter Nicholson, and Mr. Bevan, "for much valuable information, and for the disinterested efforts which they have made to facilitate and improve the undertaking." Under better auspices, a work of this kind could scarcely have been commenced; and we sincerely hope that the author will find, in the patronage of the numerous class of individuals for whose use it has been compiled, sufficient inducement to continue it through a long series of years.

MR. WOOLGAR'S SELF-REGULATING CALENDAR.

The readers of the "Mechanics' Magazine" will recollect the ingenious Self-regulating Calendar, which our correspondent Mr. Woollgar, the President of the Lewes Mechanics' Institution, first made public in our 186th No. The description of it there given was so full and explicit, that, as stated by Mr. W., any person, "who can use a rule and compasses, may construct one for himself;" but as there are many individuals who may not choose to take this trouble, Mr. W. has authorized it to be published, in a separate and very elegant form, by Mr. Willich, of the Lithographic Establishment, Bedford-street, Covent Garden. It is asserted of it, and we believe with perfect truth, that no Calendar has hitherto appeared, possessing so much simplicity and convenience. It needs adjustment only once a year, and that is effected without reference to any other Table or Almanac. It is not, besides, liable, like other Calendars, to derangement, but shows instantly, by inspection, whether it is properly adjusted or not.

PUMP QUESTION.

Sir,—Your 224th Number contains another letter from Mr. Baddeley on the above subject. In offering the following answer, I beg to apologize for not having transmitted it before:—

In Mr. B.'s third paragraph, he allows that when my *funnel* is used, the water will have *some* tendency to rise in the pipe H F (see fig. page 278). I would ask then—1st, Whether this tendency of the water to rise would have any effect in increasing the labour of working the pump? I think not. 2d, Whether (supposing my *funnel* were not used) the current, being under the mouth of the feed-pipe, would not tend to increase the labour? I think it would. 3d, If such is the case, could not my *funnel* be used with advantage?

Mr. Baddeley says that he can prove what he asserted at page 252, by the "established principles and unalterable laws of the science of Hydrostatics." Now, Sir, I very much doubt his ability so to do, and

should be much obliged to him to undeceive me; in the mean time, I beg your readers will defer giving judgment in the case (*if possible*).

I remain, Sir,
Yours, &c.
HENRY OTTLEY.

Jan. 1, 1828.

ANSWERS TO INQUIRIES

Respecting Imitations of Rosewood and Mahogany; and Painting on Glass. (See p. 352, vol. viii.)

Sir,—The following may possibly serve as answers to the Inquiries of "J. B." and "A Subscriber," in No. 225.

Wood may be stained so as to resemble mahogany by this process:—Dissolve two drachms of dragon's blood, one drachm of alkanet root, and half a drachm of aloes, in half a pint of rectified spirits of wine. Previously to using this tincture, the wood ought to be moistened with aquafortis; when two or three coats of the former, each being allowed to dry before the next is applied, will produce the desired effect.

The best colours for painting the glasses of magic-lanterns are,—

For pink and crimson—lake or carmine.

For blue—Prussian blue.

For green—distilled verdigris.

For yellow—gamboge, worked up with strong white varnish, which may be made by either of these methods:—

1. Gum juniper, or sandrack, 1 lb.
   Strasburg turpentine, 6 oz.
   Rectified spirit of wine, 2 pts.
2. Gum sandrack, 3 lb.
   Spirit of wine, 2 galls.

H. H.

LIST OF NEW PATENTS.

THOMAS STANHOPE HOLLAND, of the city of London, Esq. for his invention of certain combinations of machinery for generating and communicating power and motion applicable to propelling of fixed machinery, as also floating bodies, carriages, and other locomotive machines. 19th December. (*Six months.*)

WILLIAM HARLAND, M.D. of Scarborough, in the county of York, for his having invented certain improvements in apparatus or machinery for propelling locomotive carriages; which improvements are also applicable to other useful purposes. 21st December. (*Six months.*)

CHARLES AUGUSTUS FERGUSON, of Mill Wall, in the Parish of All Saints, Poplar, in the county of Middlesex, mast maker, and James Falconer Allee, of Prospect-place, Deptford, in the county of Middlesex, gentleman, for their invention of certain improvements in the construction of made masts. 22d December. (*Six months.*)

WILLIAM HALE, of Colchester, in the county of Essex, merchant, for his invention of certain improvements in machinery or apparatus for propelling vessels. 22d December. (*Six months.*)

NOTICES TO CORRESPONDENTS.

Vectis will oblige us by sending some of the formulæ he mentions; those with "the alterations" would suit best for insertion.

Either we have confounded C. with another Correspondent, whose handwriting is similar, or C. is unreasonably troublesome. What is the paper to which he alludes?

We wish to know from S. Y., whether, after the new accident which has befallen the Thames Tunnel, he is still desirous that we should insert his vindicatory letter on the subject. If he will favour us with all the particulars about the Greek steam-vessels, he will find us as ready to expose misconduct in that as in any other case. The "Review" we must decline, and refer him for our reason to one of our "Notices" in No. 189.

S. R. on "Gas Lighters and Gas Light Book-makers" stands over, for want of room, till next week.

We have had several inquiries for information where models of the steam-engine and other machines may be procured, and would willingly communicate to the parties the address of any mechanic who may be inclined to employ in this way a leisure hour.

Communications received from Mr. Child—A Subscriber at Chelmsford—Mr. Taylor—Alpha Beta—Mr. Ford—L. Y.—A Sharp Blade—R. T.—Juvenis—T. M. B.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

Printed by Duckworth & Ireland, 76, Fleet-st.

Mechanics' Magazine,

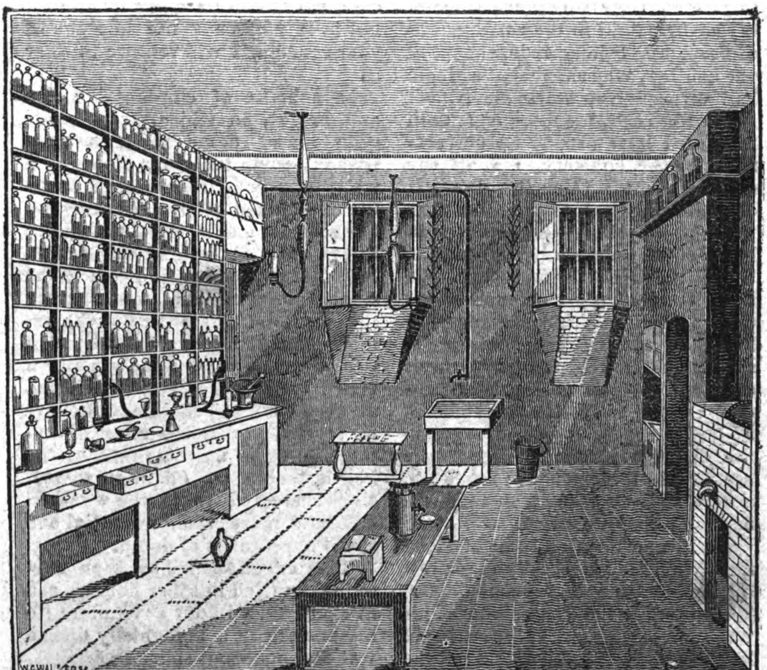
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 231.] SATURDAY, JANUARY 26, 1828. [Price 3*d.*

Serene Philosophy!
She springs aloft, with elevated pride,
Above the tangling mass of low desires,
That bind the fluttering crowd; and, angel-wing'd,
The heights of science and of virtue gains,
Where all is calm and clear.

THOMSON.

LABORATORY OF THE LONDON MECHANICS' INSTITUTION



IT was mentioned some time ago, in our Reports of the proceedings of the London Mechanics' Institution, that the "workshops," which formed so important a feature in the plan of this establishment, had at length been fitted up, and opened for the use of the members. For the above view of the Laboratory we are indebted to Mr. Davy, to whose drawing Mr. Walker has done great justice.

ON REPULSION.

Sir,—Allow me to make a few remarks upon the communications of J. Wilby, inserted in No. 196, vol. vii.; and R. L—e, in No. 206, vol. viii.; on the "Non-existence of Repulsion."

The facts mentioned by J. Wilby and R. L—e are not sufficient to justify any person in the disbelief of the existence of repulsion: those of J. W. may be explained by either hypotheses; whilst the "practical" one of R. L—e is not sufficient to overturn an hypothesis, which, in general, so well explains those phenomena which fall within its range. Neither do I think R. L—e's explanation of the first experiment satisfactory; for if the balls diverge to give off their superabundance of the electric fluid to the surrounding atmosphere, totally independent of one another, why should not a single ball diverge also when electrified. As to his second experiment, until by trial I have proved its correctness, or the contrary, I shall say nothing; but I think it will admit of a much better explanation than that given by R. L—e. Our knowledge of the materiality of caloric, light, the electric and magnetic fluids, and of the existence of attraction and repulsion, is altogether hypothetical. In the present state of science, a plausibility of hypothesis on these subjects is nearly all we can expect to arrive at; and if J. Wilby or R. L—e can explain the different phenomena generally ascribed to the agency of repulsion, as well without as with it, they will find me a ready convert.

I will now mention some of those facts which are generally explained by the doctrine of repulsion. Dr. Thompson, in the first volume of his "System of Chemistry," speaking of light, says, "The third, and not the least singular, of its peculiar properties, is, that its particles are never found cohering together, so as to form masses of any sensible magnitude. This difference between light and other bodies, can only be accounted for by supposing that its particles REPEL each other." In the same manner Dr. T. explains the similar property of caloric, and the rapidity with which its particles, when forcibly compressed, fly off in all directions.

I will thank either Mr. Wilby or R. L—e to explain, in addition to the above, the repulsion between similar magnetic poles, and remain,

Sir,

Yours truly,

HENRY H———.

Carmarthen, Dec. 21, 1827.

CURE FOR DAMP WALLS.

Sir,—One of your correspondents (in No. 225, page 251) requests a remedy for the correction of damp in houses, &c.

I cannot say whether my information will reach his particular case (as to closets and cupboards), but as it may be of use to some of your readers, I will venture to offer it.

In a house of considerable size and height, in which, upon every symptom of damp weather, even without rain, the stone floors and walls were completely wet, I made the experiment of simply taking up these floors, and laying them on dry bricks about six or nine inches high, letting the joints or joinings of the stone rest upon them, and leaving the air to circulate below the remainder of the floor; and although this attempt was merely with a view to render the floors dry, it had at once (and has continued to have for several years) the effect of drying the walls also; so that in the heaviest rain, or dampest season, they scarcely give to the weather, or show more than a partial and slight appearance of damp.

This experiment has been subsequently tried in other houses, and in churches, without any failure (to my knowledge), and chiefly upon a wet and tenacious soil.

I presume the same success would attend the re-laying of wood floors now placed upon the ground, at least as far as regards the floors alone. The attempt is, at any rate, of comparatively light expense and trouble.

I am, Sir, yours, &c.

W. A.

FURTHER EXPLANATION OF MR. JOPLING'S SEPTENARY SYSTEM, AND REPLIES TO MESSRS. DESVIGNES AND IBBETSON.*

Sir,—In No. 211, p. 117, I have given the order of variation in the curves of the *Third Case*, Third Division; and I have also there given the order in a case in another Division, in which that law is just reversed.

I wish now briefly to state, that a gradual connexion may be traced between the former of these and the conchoids; in each of which there is also a harmony of variation—a series of nodes in each passing through one common point. And the order, in the case in which the law is reversed, harmonizes with the variations in lines connected with the cissoid, in which the crossing of every node is at a different point.

From this I conclude that the conchoids are cardioids, having some quantity become infinite; and that the cissoids, &c. are the infinite of the case in which the order of the Third Case, Third Division, is reversed. The cissoids, &c. and the finite lines with which they harmonize, have no reverse; or, in other words, the reverse is the same.

The principle of the cyclographs clearly demonstrates that a gradual variation may be obtained between a portion of an infinite circle and any portion of a finite circle; and it may be as clearly demonstrated that a gradual connexion may be traced between any portion of any other infinite line that can be produced, and its finite line; and probably all finite lines in this way have their infinites, and *vice versâ*.

In the infinite ellipse (if I may call it so)—a portion of which may be described by my apparatus—the major axis only is infinite, the minor finite; that is, the describing point continually recedes from the major axis; but however far the line may be produced, the distance will never be equal to a certain quantity, which is half the minor axis; and there can be no point of contrary flexure.

In a portion of a circle having become infinite, the character (if I may so say) of the finite is lost; for there is nothing of the character of the circle in the straight; but in many other lines, the character of the finite is retained in the infinite. This arises from some quantity or quantities only, as I have stated, having become infinite, while other quantities remain finite.

Fig. 1 shows the method of generating the conchoids. The right line C B and the pole *b* are at rest; the pole *a* being directed by sliding *along* the line C B, and the right line E F carrying the describing point, and sliding *against* the pole *b*.

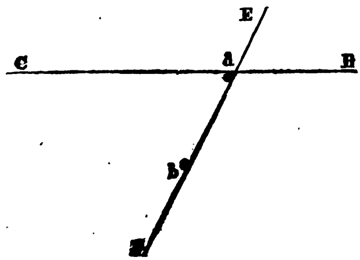


Fig. 2 shows the method of generating the cardioid of M. Carré. Instead of the pole *a* moving along a right line, as in fig. 1, in this it moves in a circle passing through the pole *b*; the other circumstances being the same in both figures.

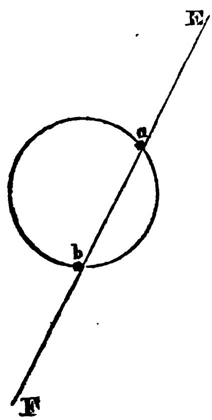
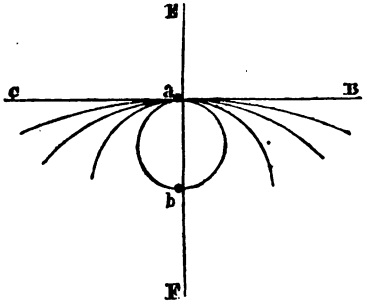


Fig. 3 (next page) shows both the former figures, and also how the connexion may be traced between these principles of generation, by supposing the pole *a* to move in a series of arcs between the circle and the right line C B.

By this method of showing the passage from the conchoid to the cardioid, the pole *a* may be moved along an intermediate line, so that every point in the

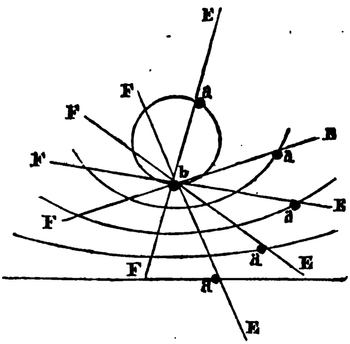
* It is proper to state, that the present communication was received from Mr. Jopling several days prior to the appearance of Mr. Rice's letter in our last Number.

line E F will describe a circle. Thus, if correct examples were given to show the



character of the lines at the extremes, and at an intermediate adjustment, the effects of all other adjustments between the cardioid and conchoid may be antici-pated; and consequently the way may be known, by which the required varia-tion for any adjustment may be made.

Fig. 4 shows another method of pass-ing from the conchoid to the cardioid, in which no distinct intermediate character occurs, but only a gradual variation from the one to the other. Perhaps some of your mathematical readers will give a demonstration of this.



As there are one or two circumstances in Mr. Desvignes's letter, which per-haps I ought to notice, but which I had overlooked, or not stated sufficiently dis-tinct, in my reply to him, I avail myself of this opportunity of doing so.

Mr. D., in a note, alludes to a draw-ing ("consisting chiefly of spirals") which he showed me; and perhaps he would wish your readers to suppose that he had at that time invented an instru-ment for the purpose. But that is not the case; he had not then *seen*, con-structed, or used, any apparatus for drawing volutes.

From what I have already stated, per-haps, it is almost unnecessary to say, that it was impossible for me to copy from that which I never saw, heard described, or even heard of, until long after the Septenary System was formed—viz. Mr. D.'s rose-engine; yet he states that I have *copied* it, as well as Suardi and Adams.

Perhaps Mr. D. considers his letter to me (to which I alluded in my last), the statements noticed above, and other parts of his reply, as *pardonable* "de-viations from truth." I will thank him to refer to the page in Adams, where ("*word for word*") *his quota-tion is to be found.*

I had written thus far when I received your 227th Number, containing the con-tinuation of Mr. D.'s reply, on which I shall now make a few observations, reserving others until his promised addi-tional letter appears.

The basis of Mr. D.'s *First Division* is the unwinding of a string from any given form: this, as applied to cylinders, produces the evolute of Huyghens to which I have already referred (No. 211, p. 119, and No. 226, p. 262); and I there state, that a straight ruler may be substituted for the string, and that to the ruler a plane may be added: this forms a case in the Sixth Division of the Septenary System, which at any rate, in part, also includes Mr. D.'s *Second* Division, which he says "is on the principle of the rose-engine;" and he has before stated that the rose-engine includes the Septenary System.

I have already said that the primary principles of Suardi's Pen form one division of my system—and this forms Mr. D's *Third* Division.

If Mr. D.'s rose-engine does not in-clude the basis of Suardi's Pen, it cannot include the Septenary System; and if it does include it, what necessity is there to make two divisions of one and the same thing?

Mr. D.'s Fourth Division is a combi-nation of the principles included in the Septenary System, one of which motions forms the basis of his First Division, and a *case* as I have stated in my *Sixth* Divi-sion. The method of directing a point by the intersection of lines, either right or curved, is also in the Septenary Sys-tem, as may be seen by the accompany-ing figures. Perhaps the various motions of this description are not in Mr. D.'s rose-engine, therefore he concludes they are not in the Septenary System. If Mr. D. confine his ideas to *tangents*

and *secants*, the operation of this division of his, will be comparatively very limited; any other, *right* lines for example, either parallel or making any angle with either the tangent or secant, may be used—or, instead of the secant, any other line either beyond or between the tangent and secant may be employed; and the describing point need not be confined to the point of intersection. Again, the method of directing a point by the intersection of lines has been much noticed by writers on the generation of curves; and if this were applied to the First Division of the Septenary System, the lines of the curves, &c. would be described; amongst which, all the conic sections, and the lines of third order enumerated by Sir I. Newton and others, I think, might be produced. The ellipse and hyperbola are unquestionably amongst the *lines of the curves* (which are infinite in variety) in the First Division. Such combinations of motions, although correct in theory, are not so easily applicable, and cannot be managed with such a degree of accuracy as the more simple operations.

It may be necessary to remind your readers, that Mr. D. commenced by saying his "*Four Divisions comprised a* FEW *of the principles*;" he now, however, states they "*constitute* his system." Perhaps he will, in his promised communication, state what has become of his other principles, and if he has formed them into a system.

I beg now to say, that I congratulate Mr. D. on the discovery of his pins, cork, and plaster method; at the same time, I would ask him if he thinks such spirals more accurate than those drawn with compasses, and also, what are the advantages he expects to derive from such approximations.

I think it almost unnecessary to say, that there is no probability that the Greeks ever made use of any such method as Mr. D.'s third figure, which he does well to say, "*approaches* the Erecthean volutes;" for, although he may by such means draw lines through given points, yet such lines, after all, are only portions of circles of different radii; any two portions being joined together at the same tangent.

Mr. Ibbetson states that his "last two engravings cannot be produced by my system." I have already said the combinations of the primary principles are unlimited; consequently, it is quite impossible to say what can, or cannot, be done by them. I have also said that combinations may be traced to a limited extent. The Septenary System consists of seven general divisions, which contain more than forty cases of simple motion. Now, each single case of motion might be combined with each single case of motion only; or any three or four single cases of motion might be combined with each other, a classification formed, and their effects traced; but to ring all the changes that might be produced by all the simple cases of motion only, I shall not at present attempt to calculate. Twelve cases, in this way, would produce more than 479 millions of cases of combination.

What I have said of Mr. Child's, I may say of Mr. Ibbetson's specimens,—that a small portion of each line contains all the variation of curvature; in the two examples he refers to, one-sixteenth. And both portions are very simple lines; the one having no point of contrary flexure, the other having only one.

I have myself made a few simple combinations, and I think it highly probable that many useful ones may be made; but I would again repeat that it is only to the developement of the gradual connexion, the harmony, the effects, and the simple application of the primary principles, that my ambition at present extends,—when I have accomplished this, it will give me great pleasure to advance: in the mean time, however, it will be interesting to me to hear that others are forming useful combinations; and it would be still more so, to see descriptions and names of instruments in the most simple terms.

As to the terms and diagrams that I have made use of to describe the motions of my First Division (which I have published in the first Number of the "Illustration"), I will leave it to you, Sir, to judge of their propriety.*

If these are proper, and if it be desirable that all the other simple motions should be clearly described, some one classification should be adopted; for if each person invent terms, and form his own classification, a degree of confusion must necessarily be the consequence. Indeed, what Mr. Desvignes, in one instance, calls a *Division*, I have called a *Case* in a Division; what he calls another Division, I should call a combination of Cases in different Divisions; and what, perhaps, he would call Cases, I should call varieties of the same Case.

The cyclograph, the arcograph, and the curvilinead, are all constructed on the same principle, and for the same purpose— and one name would surely

* We shall notice the publication alluded to, in an early Number.

be sufficient; if an improvement on the same principle be made, let it be distinguished by the author's name, if any distinction be necessary.

Previously to hearing of the name of Mr. Desvignes's instrument, a classical friend had furnished me with the word Speirograph—differing but little from Mr. D.'s, his being Speiragraph. The term, however, I have not adopted, as it conveys no idea of the particular motions by which the lines are produced. As instruments may be constructed on different principles, to have the same and different effects, it appears to me important that, in such cases, they should have distinguishing names.

I am, Sir,
Your obedient Servant,
JOSEPH JOPLING.

P. S. When Mr. Desvignes has made his additional promised communication, I will, if necessary, make further observations.

SHALDERS'S PATENT GRAVITATING EXPRESSING FOUNTAIN.

Sir,—In availing myself of your polite offer to give a place in the body of your work to a notice of my new fountain, I will be as brief as possible; but having to write of writers who write and do not think, to readers who read and do think, to noblemen and others who think and inquire a great deal, I hope for your indulgent consideration, should I seem to trespass on your pages.

I am, Sir, &c.
WM. SHALDERS,
Expressing Fountain Patentee, Bank Place, Norwich.

In the "Register of the Arts and Sciences," page 151, there appeared the following, among other remarks, in regard to the "*Gravitating Expressing Fountain*," for which I had some time before taken out a patent:—

"This new invention is one of the oldest contrivances we ever met with in the specification of a patent. It is of the nature of a force-pump, and without doubt is a very effective machine for a temporary purpose, where good pumps are not easily attainable; but the frailty of the materials, and the rudeness of its construction, will, we think, prevent its adoption in the present age. In other cases, the Patentee has, we hope, found it to answer his purpose, and, we dare say, has felt infinite satisfaction in his discovery; but, in attempting to secure to himself, by patent right, the exclusive privilege of using the machine, we fear he has expressed more money out of his pocket than will ever gravitate into it again from the same cause."

TO WRITERS WHO DO NOT THINK.—Where, pray Sirs, will you find this "one of the oldest contrivances?" My neighbours have searched their own and the public libraries, and can find no trace of any machine resembling it in its capacity for raising water, in the proportion of 100 to 57—I mean when compared to pumps, with well-packed pistons working in metallic cylinders. I confidently defy you to find any machine like the fountains in all their parts. Some things there may have been, a little similar—but none which ever produced such good action, good effect, or possessed such durability. If the principle which gives such superior efficiency to the Expressing Fountain were known before, why were not similar effects produced before, and fluids raised without wasting power? Why have all mechanical works so long repeated the hydraulic lamentation, that the quantity of water actually raised by any machine is not often more than half the power consumed after overcoming friction, &c.? With piston pumps, this must, indeed, always be the case, except the lateral pressure of fluids should determine, and gravitation cease; and herein their inferiority to mine consists.

Next, for the *defects* of the Fountain,—the "frailty of the materials, and the rudeness of the construction."—The first I sold was placed in a *well*, to supply a large tan-yard with water, in April 1826. A few days after, I sold another for a similar purpose. Each of them has raised many thousand tons, and the same connecters continue to perform *as well as at first*. I saw, on the 18th of September, 1827, a brewer, who had put one to work at his premises on the 10th of last March, and raised from ten to twenty tons, daily, to the height of twenty-eight feet; three days before, he had looked at the lower valve, and found the connecter as good as at first. So much, then, for their frailty! But it seems they are not only frail, but rude in construction. One line may suffice to dispose of this absurd objection,—*they may be and are made as handsome, as their action is elegant.*

You assert that a steam-engine would be necesary to work the double motion fifteen-inch fountain in the specification. You ought to know that the power required is governed by the length of the dip, and the height to which the water

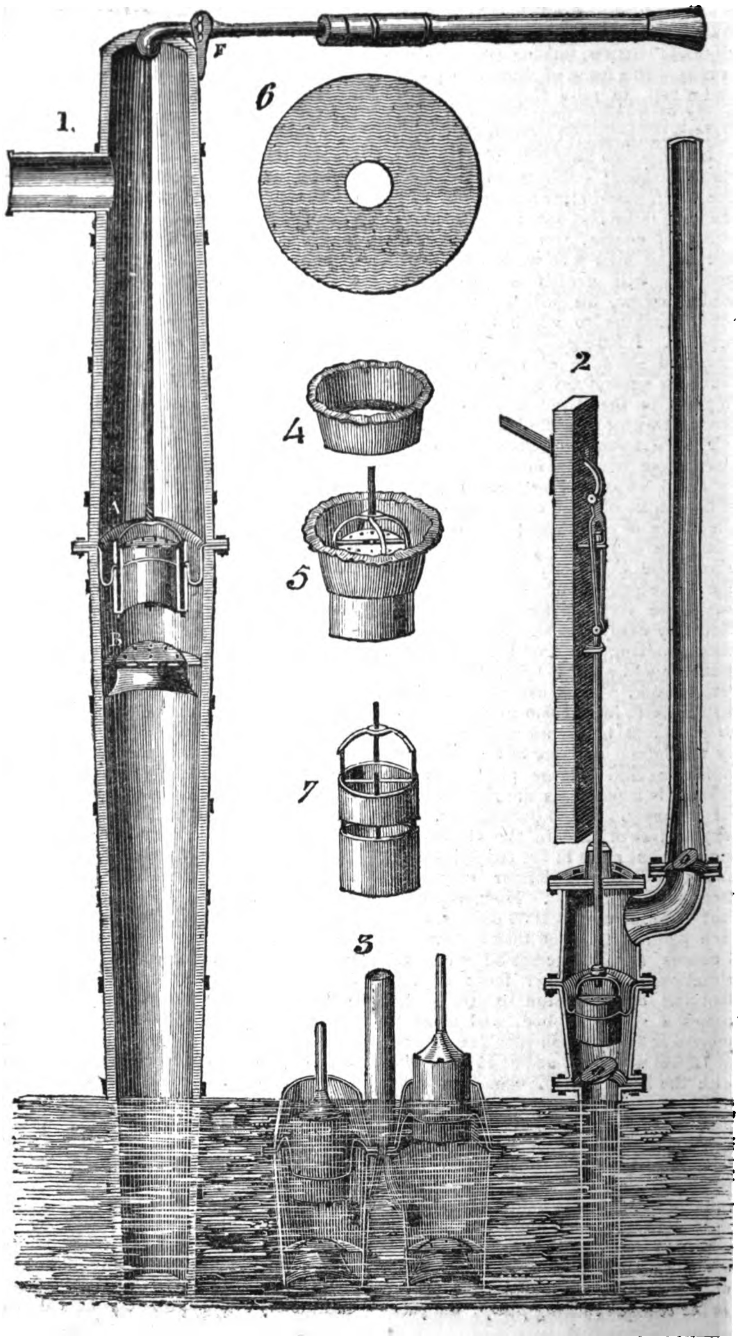
is to be raised, and not alone by capacity. An eighteen-inch double fountain would require two men, turning nineteen-inch cranks with a force of sixty-two pounds and a half, to raise three cubic feet of water, each round, fourteen inches high; making thirty-six revolutions per minute, would raise two hundred and forty cubic yards per hour; and in twenty hours and one-third, would clear one acre of water that was three feet deep; and by the extreme, of course, you know the mean power the men will work with. The fountain will greatly surpass Archimedes' screw, his pupil's pump, or any other machine to which they can be opposed. I have publicly offered bounties, and shall be glad to match the fountains against any machine, in order to prove to the world which will raise the most water with the least power.

The PHILOSOPHER will expect I should show cause why my fountain should be so much superior in effect to pumps. Whereas, no one can obtain more than the whole of any thing; the fountains cannot be more than perfect machines. That their superiority must arise from the imperfections of pumps, and that pumps are very imperfect machines, are facts very easily proved. A well-packed piston, moving in a true bored cylinder, must rub against the tube, or the fluid reverts back. The usual way of packing pistons, is to leave room for the packing to play, and be forced against the tube by the lateral pressure of the fluid; by which method a large portion of the rubbing is avoided, as the piston returns for its supply. When packed firm, there may be less friction in the discharging motion, but more in the supplying one; and therefore the former method is thought to be the best. Now, as a cubic foot of water weighs 1000 ounces, every inch perpendicular of that foot weighs 7 ounces nearly, increasing with the elevation 7 ounces per foot: so that that part of the piston so pressed becomes a sledge or hoe, and must be pressed at 36 feet high with 250 ounces; at 72 feet with 500; and at 144 feet high with the 1000 ounces, upon the square inch. Hence the calculation, that a man can raise for a short time, with a good pump, 500 pounds of water to 10 feet, or 50 pounds to 100 feet high, per minute, may be nearly correct; the cylinder being proportioned according to the height to which the water is to be raised, so that when the lateral pressure of the fluid is the greatest, the number of inches so pressed may be the fewest. *In the common sucking pump*, the packing of the piston being forced against the sides of the tube by the sideward pressure of the fluid, causes friction; the fluid sticking against the tube, adhesion. At every dip of the piston, instant rest is acquired by them both, and causes inertia: and that this last is a resistance is shockingly evident—convulsing at every stroke the face of the operator, when working at a short effective pump—and at once proves that the piston of a pump is nothing more than a reciprocating sledge moving a weight over a smooth surface with a SLIDING MOTION; whilst, on the other hand, THE EXPRESSERS IN THE FOUNTAINS MOVE AS FREELY AS FISHES IN THE SEA.

The Expressing Fountain is supplied by rarefaction. The connecter being of superior gravity to water, descends with the expresser in that fluid. The expresser, when rising, acting as a mast does to a sail, guides and supports the connecter, which presses the side of the fluid to the centre as NATURE DIRECTS, and raises a weight on a wheel turning on a fluid axis with a ROLLING MOTION. Again, the piston slides the fluid in a compact form, as though it were a solid,—a course that fluids at liberty never pursue. The united power of the steam-engines in use, would be inadequate to violate the course of Father Thames in like manner, and compel him to move at the bottom, centre, and the surface, with equal velocity. More to the point: did not fluids abhor sliding against tubes, would mercury rise with a convex, and fall with a concave head in changeable weather? And, upon this ground, will the fountains overmatch that very refined machine, the quicksilver pump.

To Noblemen and others, who inquire whether the fountain can be used to advantage as a DRIVING POWER.—The following facts will enable their engineers to decide and reply to all inquiries upon that head. A horse moving with 160 pounds power, with a velocity of 44 inches per second, would raise to 10 feet high nearly 93 tons per hour. Would that weight of water, falling 10 feet, grind more wheat than the horse would, working at the machine? In "Young's Philosophy," it stands thus:—Nine tons of water, falling 10 feet, will grind and dress a bushel of wheat. If this be correct, the above-mentioned power would grind more than a last and a half in twelve hours, going a distance of 30 miles.

TO THE PUBLIC.—As the most satisfactory evidence that can be adduced



1.
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of the great gain which is effected by the Expressing Fountain, I will here give the reports which have been furnished to me, of the satisfaction it has given to different purchasers in various parts, and in their own words. One gentleman writes thus :—"Sir,—My man used to be pumping eight hours daily; now he performs the same work with the fountain in three hours and a half." A second—"My pump was for ever noising in my ears; now my work is done in half the time, almost in silence. I will never be without the fountain, cost what it will." A third—"My man can fill a vat, with the fountain, requiring fifteen imperial barrels (5400lbs.), in five minutes, raising the water ten feet high." A fourth—"I am perfectly satisfied with the fountain." A fifth, a tanner—"I have had the fountain in constant use eight months; my man, last week, put in the new five shilling connecter, and it performs as well as at first; I think they will be less expensive than pumps, and do double the work." And a sixth says—"My boys, when working at the fountain, make more eighteen-pound strokes in a minute, raising the water ten feet high, than they can make twelve-pound strokes with the pump, raising the water eight and a half feet only, which is as 180 to 102." This last agrees with my own experiment, when the fountain was tried against the best pump I have yet seen, which I obtained from an eminent maker in London. When both machines raise water to the same height, any of the men can always make more strokes of 24 pounds each with the fountain, in a minute, than they can make strokes of 14 pounds each with the pump; but with a fountain that delivers 30 pounds each stroke, not quite so many. This fact accords well with very high authority, namely a SCALE BEAM; for when the rods of either machine are attached at one end, and weights at the other, one requires weights for the weight of the fluid only, the other a large addition of about eleven in twenty-six, to overcome the friction, &c.

One connecter has raised about 40,000 hogsheads to 10 feet; another, 12,000 hogsheads to 30 feet high, and appears none the worse; a third raises water to 100 feet high with the same facility, and will sustain ten times the pressure of the 43 pounds 6 ounces upon the square inch, which that height requires. But nevertheless, at present, I do not wish to undertake to raise water to more than 40 feet, for which height their capacity and durability are fully established.

Connecters ready prepared and numbered are about five shillings each; which are as easily fixed into fountains as flints are into muskets. But little more than a sufficient dip can be obtained; therefore the fountains require to be nicely adjusted; and being very powerful, large water-ways are essential. But when once well proportioned, they can be put and kept in perfect action by any mechanic; and to all persons wanting to raise large quantities of water, this invention is of great importance. The Alexandrine SLIDING PISTON is left at such a frightful distance by the English CONNECTED EXPRESSER, that, to what grand purposes this powerful principle may be applied, I leave to time to disclose.

W. S.

Description of the Drawings.

Fig. 1 represents a ten-feet Expressing Fountain, complete. A is the upper valve; B the lower valve; F the fulcrum. Fig. 2, Fountain for well, or fire-engine. Fig. 3, a double-motion Gravitating Expressing Fountain. Fig. 4, connecter blocked. Fig. 5, connecter and expresser. Fig. 6, leather for connecter. Fig. 7, expresser parted.

If the reader will keep in his mind's eye, that at equal altitudes fluids press in all directions alike, he will see that in fig. 3, which is supplied by gravitation, the connecters are kept in their right position by the upward pressure; and in figs. 1 and 2, which are influenced by rarefaction, the connecters are kept in their right position by the downward pressure of the fluid. I trust these explanations will make the action of the fountain easily comprehended.

THE THAMES TUNNEL.

The newspapers now state (apparently on official authority) that "had the Company been in a better condition as regards funds, the operation of forming an artificial bed to the river, by the application of clay in the line of the tunnel, would have been adopted;" and they also now admit that "such a course would, in all probability, have prevented the recurrence of the accident." But what economy! For want of this artificial bed, the river

has broken in again, and an extent of damage been occasioned (to say nothing of the injury done to the reputation of the concern), which, judging from the expense of stopping up the last hole (12,000*l.*), will cost at least six times more than the means of prevention would have cost! What ought to be said too, on the ground of humanity, of exposing hundreds of industrious individuals to destruction on a mere pound-saving speculation?

Mr. Brunel is now busily endeavouring to stop up the new hole by means of bags of clay, which he hopes to find as effectual on the present as on the former occasion; and he is said to "express himself in the most sanguine manner as to the completion of the undertaking, if capital can only be obtained." Shall we tell Mr. Brunel the surest way to get the capital which is still wanted? Let him satisfy the public that he has taken such measures (which he may do) as will effectually prevent the river from again bursting in; let him only do this, and capitalists will be found in abundance to advance the money requisite to complete the undertaking (on the security, of course, of the *first returns*). There is a talk, we observe, of raising, by *subscription*, the necessary funds. Nothing but absolute despair could suggest any dependance on such a resource. A few *decoy ducks* may make a display of the fifties and hundreds which they are ready to give in aid of the concern, but the public at large must have sense enough to perceive that it is none of their business to find money to save individuals from the consequences of their own miscalculations and errors. He must be simple indeed, who supposes, for a moment, that it can reflect any reproach on us, as a nation, that a speculative engineer (of no experience in mining), and a few other speculators, of more wealth than wisdom, have attempted more than they may be able to accomplish.

The subjoined is a letter which we have received on the subject of the late accident from Mr. Deakin, the author of the ingenious "Plan of Tunnelling," which we inserted in a former Number. He agrees with us in thinking that it was no more than what might have been expected; and gives some additional reasons. The plan which he proposes, of excavating only one archway at a time, is particularly deserving of attention; and not the less so, that the same thing was suggested by Mr. Donkin, engineer, shortly after the former accident, but rejected, like almost every other piece of advice which Mr. Brunel has received from men of talent and experience on the subject.

Sir,—It seems that the Thames Tunnel is again full of water. I am sorry this should be the case, and for the loss of life it has occasioned; but it is nothing more than I expected. It is a wonder to me, indeed, how the tunnel has been moved forward at all, 40 feet in breadth (before the mason work is in), with such a weight of water so close upon them. As it is, there is the whole weight of the river on their heads; and that increased by the motion of the tides, &c. If there had been 40 or 50 feet of earth over-head, the water in the river would not have weighed one ounce upon the tunnel, providing care were taken that no more of the material was moved between the crown of the arch and the river than was barely necessary for the proper formation of the tunnel. I have no doubt but much of the fault is, the two arches being so near together; they should have been so far apart, that the working of the one should not have interfered with the working of the other. If I understand the plan of working the Thames Tunnel, the whole of the ground is taken out 40 feet (or nearly so) in breadth; both arches are placed in that space, and the square filled up with mason-work all round the two arches; therefore the one cannot be moved forward without the other: if it could, it would have narrowed the bearing of the water in the river, and, consequently, its

weight on the excavation. As it is, they must both go together. If two arches were absolutely necessary, what inconvenience would have arisen if the arches had been 20 yards apart, with openings at regular distances, say 50 or 100 yards apart, and across from one to the other? Had that been the case, the one might have been completed before the other was begun; and after that, the first could have been acted upon in all the cross drifts from one to the other, and *(on my plan of tunnelling)*, the spoil from the second taken out at both ends of the first. The weight of the river upon the excavation of the single arches, even if they were as near the water as the double ones are now, would not have been one-fourth the weight as on the present plan. If the single arch were 50 feet under the bed of the river, the weight of it would be nothing upon the excavation; and the expense in bricks and mason-work would be less than half the expense for those articles on the present plan.

I am, Sir,
Your humble Servant,
THOS. DEAKIN.

Blaenavon Iron-works,
Jan. 17, 1828.

APOLOGY FOR MR. BRUNEL, AND A WORD OR TWO TO MR. GALLOWAY.

Sir,—Many of the remarks on the Thames Tunnel, which have appeared in your Magazine, seem to me inconsiderate and illiberal. And without entering into a formal defence of Mr. Brunel (which I conceive quite unnecessary), I must beg leave to say, that if errors in the estimate of any undertaking in the whole range of the profession of civil engineering can admit of excuse, it is certainly this of the Thames Tunnel. It is not like a bridge, or a canal, or any other work, of which sufficient have been executed to make the practical details familiar: it is the first work of its kind, in every respect—and the only one, to the best of my knowledge—which has ever been undertaken with sufficient method to render its success probable; and that method is entirely new. These things should be considered and allowed for.

It is certainly a very great pity, that the plan recommended by you, or some such, has not been followed by those who have the direction of the works at the Tunnel. I cannot, however, agree with all your remarks on the subject. Even a double depth of earth above the crown of the arch would not, in all probability, have made the supporting power doubly strong; while the drainage from land-springs would have been increased, the Tunnel would have been considerably longer, and the whole work much more expensive, and much less convenient.

The great error seems to be, not having had the bed of the river *properly* examined. It was, doubtless, examined in such a manner as was deemed sufficient. If I may be allowed to give an opinion on the matter, I must say, I think the nature of the soil ought to have been ascertained at numerous places; the distances between which should not have been less than the breadth of the holes made by the common ballast machines. It is very easy to see this *now*, because the late accident (which doubtless arose from one of these holes having been overlooked) has made it evident. The necessity of such an examination is strongly impressed on the mind of every one, by the unfortunate circumstances with which its neglect has been accompanied; and every body wonders it was not thought of, and attended to. That it was not, is certainly most unfortunate. But who is the greatest sufferer? Unquestionably Mr. Brunel himself, whose interests and feelings in the matter can bear no comparison with those of any other individual in the world. As to calling in other engineers, as you propose, I cannot see what they are to do when they come. The error has been, *not sufficiently watching and examining the state and soil of the bed of the river.* To do this does not require any wonderful abilities, or long ex-

perience: the necessity of it has been sufficiently enforced, and the neglect sufficiently punished, to destroy all chance of its being neglected in future. Why, then, are other engineers to be called in? and what are they to be called in to do?

But the fact is, Mr. Editor, this undertaking has from the beginning met with the most illiberal treatment. When some blunder is committed in the building of a bridge, in consequence of the effects of the expansion of iron by heat having been totally neglected or forgotten, the public scarcely hear of it. When some error is fallen into in the construction of a stone bridge, of sufficient importance to bring the engineer two or three hundred miles post haste, the public never even know what it is. But the engineer for the Tunnel is a man whose genius has hitherto been exercised in a different branch of his profession: there is no fear of his bringing it to a successful termination, unless stopped for want of funds; and the plodders in the art feel mortified and degraded, that genius should accomplish an undertaking which has baffled the united efforts of experience and common-place understandings. In other great works, if the engineer commits a blunder, the settlement of it is left to him and the Directors. But *here*, the difficulties successfully overcome are unnoticed; but when an accident happens, every blockhead feels himself authorized to find fault, and offer some silly plan for remedying the evil:—like a harmless friend of mine, who was in a very great rage at the late accident, and declared that the bottom of the river ought to have been covered with sheet-iron! Mr. B. never thought of this, I dare say.

The conduct of that mighty power, the press, on two subjects, surprises me: the one is its treatment of the Tunnel, and the other, the total indifference it exhibits to the misapplication of the Greek Loan. Does no one take sufficient interest in this matter, even to *inquire* how the money came to be squandered in the shameful manner it has been? Will no one ask Mr. Galloway how he came to make such egregiously stupid blunders? Will no one inquire how it happened that the attempts to correct these blunders were suffered to be made extra charges of? or how it came to pass that a vessel on which so much money* had been expended, was suffered to be burnt, in consequence of coals being stowed *between her sides and the sides of the boiler?* Does no one feel curious to know why the money raised for the purpose of assisting the struggling Greeks, has been, to all appearance, only applied to the benefit of a few private individuals? And has no one honesty enough to feel ashamed of the affair?

I must beg leave to say, that I have no connexion or acquaintance, in any way whatever, with either of the individuals named above; nor do I expect ever to have. What I write are my own opinions and feelings on the subjects, unbiassed by interest, and unprejudiced by partiality.

I am, Sir,
Yours, &c.
S. Y.
A Young Engineer.

S. Y. asks "Why should other engineers be called in?" We will answer him in his own words—because the reason of the past blunders has been "*not sufficiently watching and examining the state and soil of the bed of the river.*" Since Mr. Brunel has been so remiss in this respect, does not prudence dictate that the Directors should have some better assurance than Mr. Brunel's, that every necessary precaution is taken in future? Need we repeat, that this is *a life and death case,* in which considerations of delicacy are least of all to be regarded?

The *difficulty* of the undertaking has never been disputed, though certainly much exaggerated. All that our correspondent says about the mortification felt by "plodders in the art," because "genius should

* We have heard it stated at 76,000*l*.!—EDIT.

accomplish what has baffled the united efforts of experience and common-place understandings," &c. is, we are convinced, without a shadow of foundation. There have been but *two* other "efforts" made, to which our correspondent can allude. The one was by Mr. Dodd, who, notoriously, was a man neither of "common-place understanding" nor of "experience," but a very ingenious schemer, without any practical talent whatever: the other was by Mr. Trevethick, whom nobody, that knows any thing of him, would think of classing as inferior either in "genius" or in executive ability to Mr. Brunel. It is well known besides, that what Mr. Trevethick did, was merely to push a drift-way under the river, in order to ascertain whether a tunnel might be afterwards attempted with safety; and that as far as it went, the results were perfectly satisfactory.

The attack which our correspondent makes on the press, for its conduct in regard to Mr. Brunel and his tunnel, quite surprises us. It has done nothing (speaking of it generally) but laud the undertaking to the stars; and give currency to the most puffing and delusive representations respecting it; (imposed upon, no doubt), and now it is blamed for unkindness! S. Y. must have in his eye the caution and reserve which the press may be expected to exercise *in future*, and not the conduct which it has hitherto displayed. —Neither are we aware that the press has been so tender as our correspondent would have it believed, in regard to the reputation of the persons concerned in the Greek affair. At all events, misconduct on the part of Mr. Galloway (as to which, be it remarked, we offer no opinion, and would wish our readers to suspend their judgments) can furnish no justification of misconduct on the part of another person, in quite a different affair.—EDIT.

GAS-LIGHTERS, AND GAS-LIGHT BOOK-MAKERS—MESSRS. CLEGG, CROSLEY, ACCUM, PECKSTON, &c.

Sir,—It has been justly remarked, that if a simpleton finds a cap, he is always disposed to try whether it will fit himself; and this is strikingly exemplified in a complaining letter contained in No. 228 of your excellent Magazine. Every individual whom I have heard speak of Mr. Matthews' very interesting "History of Gas-Lighting," agrees with you in opinion as to its character for great candour, honesty, and impartiality, as well as its manly and explicit exposure of the quackery which has too much marked the progress of an eminently useful art.

Mr. Peckston says, "boldly and confidently," that the *diagram* given in Mr. Matthews' Compendium, "*is not a faithful representation of the meter constructed by Mr. Crosley*"—that the "*description is imperfect and unintelligible*"—and that "no *mechanic* can understand it." Bold and confident assertions are generally the chief instruments of *quackery*, and it seems that the use of them is not confined to Messrs. Winsor and Accum; but I can confidently aver, on *better* authority than Mr. Peckston's, that Mr. Matthews' diagram is *a correct representation* of a section of Mr. Crosley's meter, so as to exhibit both its principle and mode of acting," which is Mr. M.'s professed object; and, with regard to the description, of which Mr. Peckston so positively speaks, as I deemed that of Mr. Matthews clear and intelligible, I have endeavoured to ascertain how far my own judgment was correct, by placing the figure and account (as copied by you) in the hands of several mechanics, as well as some females, not one of whom previously knew any thing of the subject. All of them, certainly, read the article with attention, and, without a single exception, every one of them proved that they perfectly understood the nature of the machine, by the correct explanations which they

gave. Perhaps some others of your readers may have made the same experiment, and can, therefore, equally estimate the value of Mr. Peckston's *bold* and *confident* assertions.

Mr. Matthews has fallen into an error, in stating that Mr. Malam exhibited a model of what he called his improvement of Mr. Clegg's meter only about a fortnight after the latter had retired from the Chartered Company's "service," whereas it was only *seven* days. The simple question is—Did this improvement originate with Mr. Clegg, or his draughtsman, Mr. Malam? The former contested the latter's claim from the first; and another instance, in the records of Gas-Lighting, evinces that a model given by the Society of Arts is not always to be admitted as a proof that the person receiving it was either the *original inventor*, or *improver*, of the article for which the reward was given.*

Whoever has read Mr. Accum's evidence, which Mr. Matthews has annexed to his "History," must be satisfied that Mr. Accum was very ignorant of the details of gas-lighting till he became acquainted with Mr. Clegg; and this is clearly shown to be the fact, by comparing the first edition of his book with that evidence. And is it not equally true, that Mr. Peckston also derived nearly *all* his information on the subject from his intercourse with Mr. Clegg? Indeed, are not the best parts of Mr. Peckston's book a *verbose* commentary on similar parts of Mr. Accum's work? Would it, then, have been unbecoming in a person so sensitive with regard to "*honest fame*," to have made some acknowledgment of his obligations? When Mr. P. shall again quote Shakspeare, he will do well to be careful to select such passages as cannot with more propriety and force be applied to himself; and as far as regards his insinuations about Mr. Clegg, I could give him a passage from Young—"He that is ungrateful," &c.;—but I forbear. Where is the instance of Mr. Clegg having ever imitated the jackdaw in the fable, who decorated himself in the plumage of the peacock, to pass himself off for a bird of a higher order? His genius was too fertile to have recourse to such mean expedients; but he has frequently had reason to complain that "others have *borrowed his inventions, and palmed them upon the public as their own*." He was too frank and communicative; and by the information he so freely and disinterestedly imparted, he certainly enabled some not very modest persons, and far inferior in talent, self-complacently to boast of their labour and experience.*

The publications of Mr. Mathews entitle him to all the praise you

* Our correspondent alludes, we presume, to the case of Mr. Benjamin Cook, who, in 1810, received a silver medal from the Society of Arts for a gas apparatus of a peculiar description (applicable both to lighting and soldering), of which he had sent them a drawing and description, but which was constructed for him by Mr. Josiah Pemberton, of Birmingham. It is a very possible case, however, that Mr. Cook was really the inventor, and that Mr. Pemberton merely followed his instructions; for the instances of treachery are not all on one side—there have been unfaithful servants as well as ungenerous employers. The circumstance which tells most against Mr. Cook is, that he makes no mention of Mr. Pemberton in any of his papers. The impugners of his claim say, that in this he showed a specimen of that excess of cunning by which guilt is so often (happily) self-convicted.—Edit.

* We happen to know, personally, a great many facts in relation to the merits of Mr. Clegg; and have no hesitation in subjoining our humble testimony in support of what is here stated. Could he have described as well as he invented, or, perhaps, been only as cautious as ingenious, his fame would have stood far higher than it does. We remember once likening him to a common well, at which all who chose supplied themselves, without thinking they incurred any obligation, and to which (a great deal worse case) some brought such *cracked pitchers*, that in returning home, they spilled by the way the better half of what they had drawn off.—Edit.

have bestowed, for the various information which they so perspicuously convey; and whether a reader can derive most advantage from the clear and concise Compendium of Mr. Matthews, at 4*s*. 6*d*., or the ponderous and prolix *guinea* octavo of Mr. Peckston, requires very little judgment to decide.

S. R.

Jan. 9, 1828.

HACKNEY MECHANICS' INSTITUTION.

Sir,—The representations of the recent alterations in the rules and orders of the late Mechanics' Institution in this place, made by your correspondent γ (page 422, 423,) are not exactly correct; permit me, therefore, to occupy a small part of your valuable publication in reply. If he had simply contented himself with stating facts only, I should not have troubled you; but when he not only indulges in wrong statements, but imputes base and unworthy motives to individuals, I feel it necessary to notice and repel his accusations. His first statement, of "a combination among the better sort of tradesmen" among the members, "to carry into effect alterations arbitrary and unjust," I must contradict *in toto*. The body from which the late alterations emanated, was a Committee chosen by the members themselves, at a General Meeting held in accordance to the Rules. That Committee, a fortnight after, made their report of what alterations they thought immediately necessary; and those amendments were, with one or two exceptions among the members, unanimously approved of: the idea of a combination is therefore entirely out of the question; and that the resolutions are neither "arbitrary" nor unjust, your correspondent might have learned, had he extended his inquiries, and not taken the expressions of one of the non-contents in our body for the sentiments of all. By personal inquiry among the members, or an application to the Secretary, he might have satisfied himself that the resolutions were both necessary and just. "They being the strongest party," he goes on to say, "have been the means," &c. The change of name is correct; we have only done what others have done: finding that "Mechanic" was a stumbling block to many, we struck out the word. Hackney is not much peopled with mechanics; it was soon found that from other quarters support for the Institution must be sought: the mechanics would not, or perhaps could not, maintain it by themselves; assistance was asked for elsewhere, and readily and cheerfully granted. The character of the majority of the members of this Institution stands too high to be swayed by any such mean and unworthy motives as those imputed to them by your correspondent. Concerning the alterations in the quarterly subscriptions, γ has attempted to work upon the feelings in favour of the mechanic. It is a pity he has overcharged the picture. By inquiry he would have learnt, that the "in addition to his two quarters' subscription" was a fiction of his informer. A member dropping his subscription for two quarters must pay an entrance fine of 7*s*. 6*d*. The number of quarters does not alter the fine; only if he have missed but one, he would prefer paying 5*s*.—that is, his arrears—to 7*s*. 6*d*. No fine is required, should he pay his year's subscription at once.

The remainder of γ's letter need not be remarked upon. He inquires the reasons for the change. His best way is, to learn them on the spot, or from some member better acquainted with the details than his friend the member. He may, however, rest satisfied, that there is no intention of excluding the mechanic from the benefits of the Institution. If the mechanics, as a body, feel themselves aggrieved, they have themselves to thank: the door is not closed against them—they may still enter; but they cannot complain if the now present members have made such regulations as may induce them, when in, to remain in. They cannot now do as they

have done, just pay 5s. for one quarter of a year, when they thought they could receive more that would tickle the ear, or gratify the eye, than in another quarter; and be sometimes members, when the Institution is in full activity, during the winter season, and then not members in the summer, when nothing, comparatively speaking, is doing. Your correspondent says, "once-valuable Institution;"—if once valuable, it will, I hope, become doubly so, when its sphere of usefulness is enlarged—not diminished—which is the object of the recent alterations. The enclosed syllabus will show what we are now doing.*

Your correspondent had better attend one lecture-night, when he will see "mechanics," "master mechanics," and "gentlemen," associating together, for their mutual benefit and support.

But I fear I shall be encroaching too much on your patience, or that of your readers; and conclude by assuring you and them, that the Hackney Literary and Scientific Institution is but an enlargement, both with respect to plan and object, of the Literary and Mechanics' Institution.

I am, Sir,
Yours, &c.
N.

GEOMETRIC PROPORTIONS.

Sir,—Your correspondent F. B., in No. 228 of your Magazine, requests to be informed what is the increase of capacity obtained by throwing two cylindrical vessels into one. A little acquaintance with those sciences which he seems to abhor so much, would have informed him that his question is one which admits of a most simple and ready lution. Multiply the contents of one vessel by the *square* of the numbers that are to be thrown into one, and the product will be the content of the vessel so increased. To take your correspondent's example, and, at the same time, to give him a familiar instance of the application of the *horrible* science of Algebra, I will suppose the contents of the first box to be represented by the letter a, and as two are the number that we wish to throw into one, $a \times (2^2)$, or $4a$, will be the content of the larger box.

Should F. B. be alarmed at the appearance of the above small letters, he may substitute any number whatever in its place without affecting the result.

I remain, Sir,
Yours respectfully,
WM. DOWLING.

* It is certainly very satisfactory.—EDIT.

MATHEMATICAL PROBLEM.

In a right-angled isosceles triangle there are given the three lines, drawn from any point within it to the three angles of the triangle—to determine the equal sides.

NOTICES TO CORRESPONDENTS.

We are obliged, for want of room, to defer the continuation of our Remarks on Steam Carriages till our next.

The present is the concluding Number of Vol. VIII.; and on the 10th of February will be published a Supplement, containing Preface, Titles, and Index; with a Portrait, engraved on steel, of Dr. Birkbeck.

Communications received from Mr. Jopling (in reply to Mr. Rice)—Mr. Wynn—S. M. L.—A Fisherman—Mr. Utting—Mr. Baddeley—Mr. Child—T. M. B.—Delta—E. S. Locke—Astro Solis—T. Lunt.

In next Number, an original account, by Sir William Congreve, of an Important Nautical Invention; also a paper, by Sir John Sinclair, on Increasing the Food of the People.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 56, Paternoster Row, London.

END OF VOL. VIII.

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